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BRIGADIER-GENERAL GEORGES FREDERICK DORIOT
Banquet Speaker for the 9th SPE Annual Technical Conference, Boston, January 21-23, 1952

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The SPE Journal Index For 1952, Volume 8

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The Society of Plastics Engineers Journal is not responsible for the views expressed by individual contributors. Copy for each issue should be received at Security Bank Bldg., Athens, Ohio, before the first of each month.

Across the Editor's Desk

It is surprising, the number of interesting things that come across the editor's desk in the course of a month. Most of it is noted with interest—and filed with regret. After all, in the limited number of pages of the Journal, we have to leave out a great deal. What we leave out, of course, is usually material that is bound to appear in one of the plastics trade journals anyway. But let's have some "for-instances."

● A release from the University of Illinois proposes that plastic pillows, inflated with helium, and sewed together to make an area of 10 to 15 acres, could be floated over baseball parks and football stadiums. No more rained out games! And now we quote, "Citizens in a dome covered community would enjoy true outdoor living with a year-round climate like that of the sub-tropics but without rain or bugs. —In summer an opening at the top would be designed to bring currents of cool air from high up down into the dome,—. Power plants and other smoke-producing installations would be kept outside." Science marches on!

● We always get a kick out of receiving free samples of things. We opened a letter the other day and found a complete grinding wheel, the world's smallest, fastened to the paper with scotch tape. The whole wheel is only 1/16 of an inch in diameter. It's made by Chicago Wheel and Mfg. Co., Chicago.

● And the number of photos of luscious young ladies, more or less dressed, is nothing short of astounding. In one day we got the following: Esther Williams swimming under water (point is, the plants, shells and rocks in the pool are Laminac plastic): another release showing a young lady holding a full-size bathtub in her arms (fiberglas-reinforced plastic, it weighs 17 pounds).

● We note with interest the program of the Svenska Plast Foreningen, meeting November 27-28 in Stockholm. We can't read Swedish, but we like to try. First thing to hit our eye is "-Plastarkeologi—Plast ar 6952," by Johan Bjorksten, presented by C. H. Jacobson. This paper made a hit at the 1952 SPE Conference in Chicago. The rest of the Swedish program looks impressive, too.

● Hat off to Ward T. Van Orman, for the invitations to the Cleveland Christmas party. Very clever, and includes

(Please turn to page 4)

POSITIONS OPEN

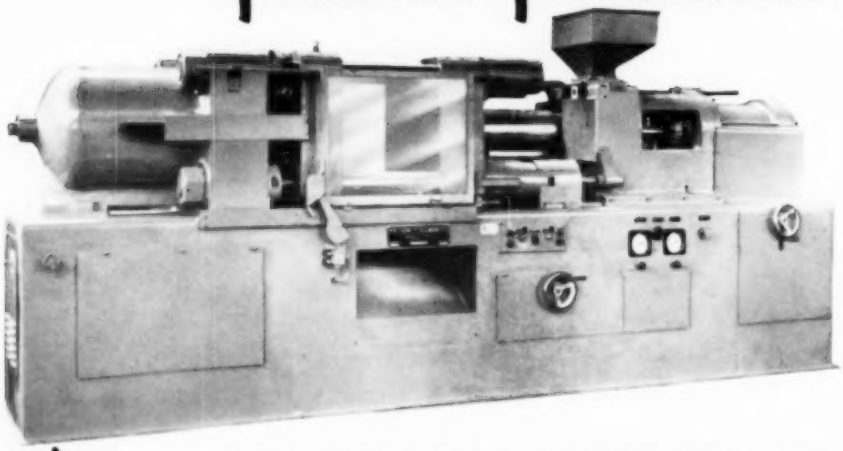
REPRESENTATIVE WANTED. Company manufactures complete line of products for plastic industry. Materials also used by mirror, aircraft, and many other fields. Exclusive territories available. Box 1152, SPE Journal, 513 Security Bank Bldg., Athens, Ohio.

INDUSTRIAL ENGINEER. Large plastics manufacturer requires services of experienced industrial engineer with plastics background. Reply to box 1252, SPE Journal, 513 Security Bank Bldg., Athens, Ohio.

TECHNICAL PLASTICS SALES — Experienced man needed for newly formed progressive chemical-plastics sales concern. Excellent opportunity. Should be technically proficient but primarily interested in sales work. Knowledge of thermoplastic fabrication helpful. Some traveling involved. Send resume of experience, personal data, training and salary requirements to Box 1352, SPE Journal, 513 Security Bank Bldg., Athens, Ohio.

Three-zone temperature control

the SURE KEY to higher plastics production



the W-S 16 OUNCE HORIZONTAL MOLDING MACHINE

Experience has shown that the day-to-day shirt-sleeve jobs are done most economically on the intermediate size machines—notably the famous W-S 16 ounce Injection Molder.

There's more than size, however, behind the outstanding preference for this model. Consider, for example, a single machine in which *all* these features are offered:

- Extra long heating cylinder for increased plasticizing efficiency . . . COMPARE!
- Three-zone temperature control . . . COMPARE!
- Replaceable bronze bushings in cylinder and moving platens...COMPARE!
- Faster cycles with dual pressure controls . . . COMPARE!
- Hydraulic and electric safety controls . . . COMPARE!
- Special pumping unit . . . COMPARE!
- Remote control panel . . . COMPARE!

If *your* profits are coming in something less than the full measure, it will pay you handsomely to investigate this profit-booster NOW. Detailed literature and/or personal analysis without obligation.

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Correspondents Throughout the World

Editor's Desk

(Continued from Page 3)

the interesting instruction, "Be sure to smile at SPE Directors!"

● We get serious mail too. Elmer E. Mills, President of Elmer E. Mills Corp., writes, "The SPE Journal, Volume 8, Number 9, November, 1952, on page 7 displays an article entitled "The Injection Molderscope" by A. K. Morse, President, Injection Molder's Supply Company.

"We read this article with much interest, and found some facts which do not seem to have been borne out by our experience.

"Unfortunately, we had not read this article in which there is a definite statement that 'in a popular eight ounce machine, you can only shoot a two ounce shot without burning the powder,' before we had run six ounce parts in an eight ounce machine.

"The Bakelite C-11 is an excellent material . . . . "

● Articles about plastics appear in a great number of places, and it is tough to know where all they do appear. The SPE Journal is making an effort to rectify the situation. Next month an article will appear on the sources of plastics information, with emphasis on the currently published magazines here and abroad. We're trying to get an article presented by Irvin Wolock and Kanegis at the ACS meeting, "Plastics Literature in Government Reports," and a paper by Gordon M. Kline on "Test Methods, Specifications and Standards for Plastics." That leaves only one major field of plastics publications to be covered, the publications of the industry itself, such as Dow Diamond, Durez Molder, and so on.

Know where we can find an author for this one?

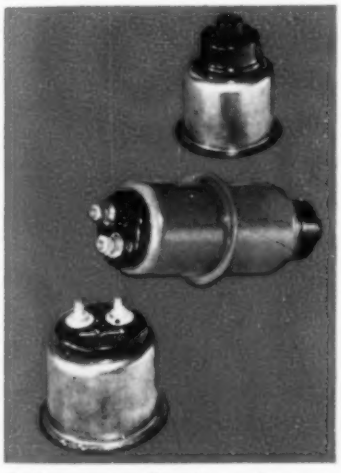
● Don't know how the story got started that the English have no sense of humor. Judging from the magazines, we'd have to say they have the best sense of humor yet—they can use humor in their advertisements! It's worth while to make an effort to get hold of an English plastics magazine just to see the monthly ads of the James Ferguson & Sons Ltd. Each ad retails some famous event in ancient history, or mythology, and it turns out that the hero every time is an early Ferguson! For some beautifully imaginative and delightful reading, Ferguson ads are the greatest invention since Christopher Morley! What's more, the drawings are nicely done, and in full color.

● The Annual Handbook of Product Design for 1953 published by Product Engineering, a McGraw-Hill Publication, is a tremendous thing, running an estimated 10 pounds in weight. No trouble at all to predict this volume is going to be liked and used by designers.

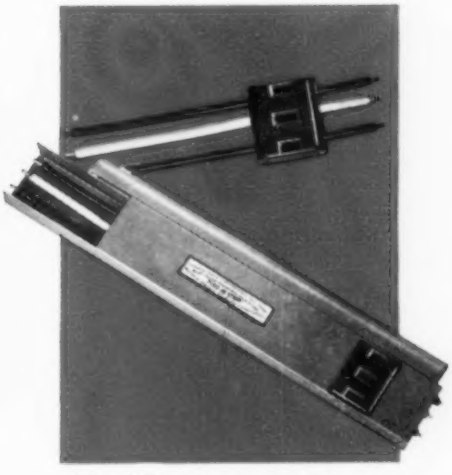
This X-ray tube housing has high dielectric and mechanical strength, withstands high operating temperatures. It's molded of BAKELITE Phenolic BM-7436, specially formulated to provide protection against radiation. **Made by Machlett Laboratories, Inc., Springdale, Conn.**

Molding speed was increased 15 per cent when BAKELITE General-Purpose Phenolic BM-18703 was selected for these wire connectors. They're low in cost, have good appearance, moisture resistance, electrical resistivity. **Molded by Ideal Industries, Inc., Sycamore, Ill.**

This impeller housing for a military radio transmitter is molded of BAKELITE General-Purpose Phenolic BM-120. It withstands vibration, shock, and temperatures ranging from —55 deg. C. to +70 deg. C. **Molded by Whitso, Inc., Schiller Park, Ill., for Collins Radio Co., Cedar Rapids, Ia.**



Resistance to vibration and to operating temperatures as high as 210 deg. F. are requirements of these primary and secondary end bodies for tractor ignition coils. They are met by BAKELITE Heat-Resistant Phenolic BM-12506, molded to metal housing. **Molded by Breyer Molding Co., Chicago, Ill., for International Harvester Co., Chicago, Ill.**



"Plug-in" strips, completely assembled, are attached to room walls to provide electrical outlets at regular intervals. Receptacles are molded of BAKELITE General-Purpose Phenolic BM-15140 for rapid production, good mechanical strength, and bleed resistance. **Made by National Electric Products Corp., Pittsburgh, Pa.**

The smooth, shiny finish, rich color, and clean design of this radio cabinet give it plenty of selling power. It's made of BAKELITE General-Purpose Phenolic BM-15155, easily molded, strong, low in cost. **Molded by Crosley Division, Avco Mfg. Corp., Cincinnati 25, Ohio.**

SIX SETS OF REASONS FOR SELECTING PHENOLICS

Heat resistance, good finish, impact strength, chemical resistance, electrical resistivity — these are just a few of the many properties that BAKELITE Phenolic Plastics can bring to a job!

And the wide variety of BAKELITE Phenolic Plastics makes it easy to pick the one that has just the right combination of properties — the one that's exactly fitted to the purpose.

The broad range of BAKELITE Phenolic Plastics makes them useful for thousands of successful applications. Perhaps they can benefit your product. Look into them as a means of improving design, performance, production.

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PROGRAM FOR THE

Ninth Annual Technical Conference

WEDNESDAY, JAN. 21

9:00 a.m. **REGISTRATION**—Mezzanine

1:00-1:45 p.m. **ANNUAL BUSINESS MEETING** of SPE Members in Parlors A, B and C.

2:00-3:15 p.m. **SPE EDUCATIONAL FORUM**
Parlors A, B and C
Session A

Moderator: Dr. James M. Church, Columbia University
Speakers: Robert C. Bartlett, National Varnished Products Corp.
Charles C. Winding, Cornell University
Edward S. Bloom, E. I. duPont de Nemours and Co., Inc.
Bryce Maxwell, Princeton University

"PROFESSIONAL TRAINING FOR THE PLASTICS INDUSTRY"

●**BIOGRAPHY:** Dr. James M. Church is Associate Professor of Chemical Engineering at Columbia University in charge of the organic and plastic technology courses. He has served as a member of the S.P.E. Education Committee since 1947 and at present is its chairman. He received his A.B. degree in Chemistry from William Jewell College in Missouri, and his Ph.D. in Organic Chemistry from The Pennsylvania State College in 1933. For eight years, he was employed as a research chemist and development engineer with the Organics Division of Monsanto Chemical Company in St. Louis, Missouri. He has been a member of the staff at Columbia University since 1940 and has contributed many technical articles to various chemical journals which have included reports of his researches in plastics technology.

●**BIOGRAPHY:** Mr. Robert C. Bartlett received his Chemical Engineering degree from Princeton University in 1941. He was a Research Engineer in plastics development for Pittsburgh Plate Glass Company, a Plastics Engineer for Navy Department, Bureau of Ships, and the Marco Chemicals, Inc. In 1948, he became Chief Chemist for National Varnished Products Corporation in charge of development and production control for electrical insulation and plastics.

●**ABSTRACT:** Results of a recent S.P.E. Education Committee Industrial Survey.

●**BIOGRAPHY:** Dr. C. C. Winding is a Professor of Engineering and Assistant Director of School of Chemical and Metalurgical Engineering at Cornell University. He is a licensed engineer and consultant to the Tide Water Associated Oil Company.

●**ABSTRACT:** Results of a recent S.P.E. Education Committee Academic Survey.

●**BIOGRAPHY:** Dr. E. S. Bloom is a Supervisor in the Polychemicals Department, Research Division, E. I. duPont deNemours & Co., Inc. He received his academic training from the Universities of Nebraska and Wisconsin. Before joining the duPont Company in 1947 he was with Allied Chemical & Dye Corp., and Parke, Davis & Co.

●**ABSTRACT:** Industry's demand for improved technical manpower.

●**BIOGRAPHY:** Mr. B. Maxwell is a Research Assistant in the Plastics Laboratory at Princeton University. He received his M.S. from Princeton in 1948 and has been active in the development of the laboratory.

●**ABSTRACT:** An answer to industry's requirements.

James M. Church

Edward S. Bloom

2:00-3:15 p.m. Session B—Georgian Room

Moderator: Edward W. Vaill, Bakelite Co.
Speakers: J. Harry DuBois, Mycalex Corp. of America, "ORGANIC PLASTICS AND GLASS BONDED MICA."
Clinton Rector, National Engineering Products, Inc., "SPECIALTY PLASTICS INCLUDING EPOXY CASTING MATERIALS."

"ORGANIC PLASTICS AND GLASS BONDED MICA"

●**BIOGRAPHY:** Mr. J. Harry DuBois, Vice President, Mycalex Corporation of America, received his B.S. degree from the University of Minnesota in 1927 and has been active in the plastics industry since that time. He has held numerous key positions in industry, such as, Manager of New Product Development for Plax Corporation; Sales Manager, Executive Engineer and Vice-President of Shaw Insulator Corporation and, Commercial Engineer in plastics for General Electric.

J. Harry DuBois

Clinton Rector

In 1948, he served as National President of Society of Plastics Engineers, Inc. He has been active in the national and local affairs of the Society since 1943.

●**ABSTRACT:** Glass-bonded mica is extensively used to gain high temperature resistance, complete dimensional stability, low power and loss factor, high arc resistance, precision dimensional control, minimum differential expansion with inserts and high dielectric. Newly developed glass-bonded synthetic mica permits elevation of temperature stability from 650°F. to 900°F., with good electrical properties in this elevated temperature range.

Experimental compounds of trifluorochloroethylene bonded synthetic mica and of tetrafluorethylene bonded synthetic mica are important materials of the future.

"SPECIALTY PLASTICS INCLUDING EPOXY CASTING MATERIALS"

●**BIOGRAPHY:** Mr. C. Rector served as Technical Sales Engineer for the Bakelite Company for approximately 14 years. Most of the time being devoted to the utilization of their synthetic resins in the formulation of brake linings, clutch facings, abrasive wheels and abrasive cloth.

From 1942 through 1944, he was connected with the Plastics Section of the War Production Board and since 1946 has served as Vice President of National Engineering Products, Inc.

3:30-4:45 p.m. Session A—Parlors A, B and C.

Moderator: Robert C. Davenport, Gregstrom Corp.

Speakers: SPE Prize Paper Contest Winners *with a synopsis of their papers.*

SYNOPSIS OF SPE PRIZE PAPERS

3:30-4:45 p.m.—Session B—Georgian Room

Moderator: Edmund S. Childs, Monsanto Chemical Co.

Speakers: Dr. Harold Narcus Electrochemical Industries, "THE METALLIZATION OF PLASTICS."

C. Paul Fortner, Plax Corp., "BIAXIALLY ORIENTED POLYSTYRENE AND METHYL METHACRYLATE."

"THE METALLIZATION OF PLASTICS"

●**BIOGRAPHY:** Dr. Harold Narcus attended Worcester Polytechnic Institute receiving a B.S. degree in Chemistry in 1934. At a later date, in 1945, he attended Graduate School at both Worcester Polytechnic Institute and Clark University to receive a M.S. and PhD. in Chemistry.

He is well-known in both the electroplating and plastics fields for his pioneer work in the field of plating on plastics and holds numerous patents in the United States, Canada, and Great Britain covering his processes.

He has presented many papers on this subject before the various technical societies throughout the country and has published many papers in the various technical journals.

Dr. Narcus is a member of the Electrochemical Society, American Electroplaters' Society, Sigma Xi, American Society for the Advancement of Science, and the American Chemical Society.

●**ABSTRACT:** This paper outlines the advantages derived from the deposition of the various metals on organic plastics based on comparisons made between unplated and plated plastics. Most noteworthy, experiments reveal a marked increase in tensile, impact and flexural strength for most synthetic resins, when plated, as compared with the values for the same resins, unplated. An appreciable increase in resistance to distortion under heat and a decrease in percentage of water absorption is obtained by complete envelopment of the plastic article in a metallic coating. The most important advantage of plating on plastics is the greater corrosion resistance of a metallic deposit when it is applied to a plastic basis than to the usual metallic basis, since there are no galvanic couples with a basis metal.

The paper points out that, basically, the main purposes for metallizing a plastic are: (1) to render it a suitable substitute for critical and strategic metals; (2) to produce a product which has the inherent properties of the plastic in addition to the desired properties of the deposited metal and (3) to utilize certain "scrap" plastics materials which otherwise would have to be reprocessed to be used.

Also is discussed the various successful methods for the metallization of plastics with particular emphasis on the proper selection of a method for

Harold Narcus

C. Paul Fortner

a particular application. It is clearly pointed out that the over-all success of plating on plastics depends upon this proper selection of the method employed.

Finally, the paper briefly discusses the most recent developments in this specialized field of plating on plastics such as the employment of "gas-plating" and the manufacture of conductive plastic materials.

"BIAXIALLY ORIENTED POLYSTYRENE AND METHACRYLATE"

●**BIOGRAPHY:** Mr. C. P. Fortner received his Bachelor of Science in Mechanical Engineering from Colorado State College of Agriculture and Mechanical Arts, Fort Collins, Colorado in 1935.

In 1941 he joined the duPont Company and worked in the Remington Arms plant at Bridgeport, Connecticut and Denver, Colorado; Atomic Energy (TNX) at Oak Ridge, Tennessee and Plastics Department in Arlington, New Jersey. He was in charge of development of extrusion techniques for duPont plastics at the Field Service Laboratory in Arlington. Since April 1952, he has been Assistant Director of Research at Plax Corporation, Hartford, Connecticut. He is a licensed Professional Engineer in New Jersey and Connecticut, and a member of S.P.E., American Society of Mechanical Engineers and Colorado Society of Engineers.

●**ABSTRACT:** A short review of some of the theories pertinent to orienting plastic sheet materials.

New data on physical properties of biaxially oriented polystyrene and poly methyl methacrylate are presented. Included in this data are information and photographs of outdoor weathering tests supplemented by weatherometer information which supports the conclusion that oriented polystyrene sheet exhibits weatherability far in excess of unoriented material.

Tests developed to indicate the quality of production runs are described. These were developed to avoid certain production difficulties, in connection with which the discussion discloses some of the features of the equipment built for producing oriented polystyrene and methacrylate sheet.

THURSDAY, JAN. 22

9:00-12:00 noon Session A—Bay State Room

Moderator: John Mallory, Parker Stamp Works

Speakers: Rene Magnenat, Waterbury Companies, Inc., "SOME REMINDERS IN MOLD CONSTRUCTION."

L. T. Raymond, Major Mold & Die Co., "LARGE MOLD CONSTRUCTION."

P. L. Geiringer, American Hydrotherm Corp., "TOMORROW'S ROLL SURFACE TEMPERATURE CONTROL AND NEW PRESS HEATING SYSTEMS."

A. J. Warner, Federal Telecommunications Laboratories, "POLYSTYRENE—TWENTY FIVE YEARS OF PROGRESS."

"SOME REMINDERS IN MOLD CONSTRUCTION"

●**BIOGRAPHY:** Mr. Rene P. Magnenat, Assistant Vice-President in Engineering, Waterbury Companies, Inc., was born in Switzerland, where he received his training in Mechanical Engineering. He started with the Waterbury Companies, Inc., as a mold maker, thirty years ago. He became a member of S.P.E. in 1950 and has been very active in the Connecticut Section since that time.

●**ABSTRACT:** There is nothing new in what follows but it has to do with the particular part of mold making which is usually taken for granted.

The "minor details" are classified into three main groups:

1. Alignment of mold halves.
2. Ejection.
3. Supporting and resisting pressure.

1. Alignment between molds.
   - A. Whether the mold is under pressure before it is closed as is the case in compression molding.
   - B. The length of the molded part in the direction of mold travel.
   - C. The size and mounting of leader pins and bushings.
2. Ejection—better lever control of the ejector pin areas on the molded part.
   - A. Troubles.
   - B. Points to follow to greatly reduce the troubles.
3. Supporting and resisting pressure.
   - A. Type and purposes of supports.
   - B. Molds built to resist pressure.

Rene Magnenat

L. T. Raymond

P. L. Geiringer

A. J. Warner

"LARGE MOLD CONSTRUCTION"

●**BIOGRAPHY:** Mr. L. T. Raymond graduated from the Henry Ford Trade School in 1928. He worked in various tool, die, and mold shops throughout Detroit. In 1941, he formed his own business, the Major Mold and Die Company. He is a member of S.P.E., S.P.I., National Tool & Die Mfg. Assn., Automotive Tool & Die Mfg. Assn., and Henry Ford Trade School Assn.

●**ABSTRACT:** Slides are being prepared showing the various phases of large mold manufacturing. Each slide will be discussed and questions from the floor will be answered.

"NEW PRESS HEATING SYSTEMS"

●**BIOGRAPHY:** Mr. P. L. Geiringer, Chief Engineer of the American Hydrotherm Corporation, is a graduate of the Technical University of Vienna in Mechanical Engineering. He has been a licensed professional engineer in Europe for many years and since 1940 in the United States. Geiringer became a citizen of the United States in 1945. Most of his professional life has been spent in design and development of high temperature fluid heating systems. He was engineer and partner of the original Caliqua Company of Berlin, Germany, who are responsible for all of the design and development of high temperature fluid heating. In 1928, he opened the Caliqua Company in Austria. Prior to coming to the United States, he served as consulting engineer for the Carrier Engineer Company, pioneers of high-temperature fluid heating in England since 1934. Up to the present time he has designed a great many industrial and district high-temperature fluid heating systems of all sizes.

Mr. Geiringer is president of the Mayflower Machine and Tool Company and the Mayflower Fuel Oil Company. During the war he began research work in electronics. Out of this has grown the Mayflower Electronics Devices, Inc., of which he is also President.

●**ABSTRACT:** The use of high temperature water for heating calenders and presses is increasing due to the current demand of the plastics industry for uninterrupted production of plastics films and coated fabrics of greater uniformity at increasingly high roll speeds. High temperature water permits maintenance of uniform surface temperatures, ease of temperature control, and ready adaptation of heating cycles as well as to the cooling cycles required when operating calenders at high roll speeds.

Cracked rolls and loss of production time and material result from attempting to cool steam-heated rolls in water. The cost of conversion to high temperature water is coming down while the costs of using steam increase. It is not advisable to attempt the application of high temperature water without the advice of engineering organizations experienced in this field.

A new surface temperature control method is now available which avoids unreliable surface temperature indicators by making use of an indirect indication of the roll or platen surface temperature. This control device is motivated directly by the heat flow to or from the roll rather than by the surface temperature, thus providing greatly superior control in the heating, cooling, and especially the transition phases of calender and press cycles.

New packaged units are shown, of the type now available for calender conversions to high temperature water. These units are inexpensive and more compact than heretofore, incorporating the benefits of considerable experience in plastics applications.

The heat accumulation capacity of high temperature water is especially advantageous for press heating, reducing fluctuations in boiler load and in the time required for each cycle. Illustrations are presented showing the application of accumulators.

"POLYSTYRENE—25 YEARS OF PROGRESS"

●**BIOGRAPHY:** Mr. A. J. Warner, Technical Director of the Chemical and Physical Laboratories of Federal Telecommunication Laboratories, Nutley, New Jersey, is a native of London, England. He joined the I.T.T. System in 1930 and was transferred to the United States in 1941. Since 1934, he has been actively engaged in research and development in the field of plastics, particularly styrene and its derivatives. Mr. Warner was the founder president of the Newark Section of the Society of Plastics Engineers.

9:00-12:00 noon Session B—Georgian Room

Moderator: George S. Laaff, The Bolta Company

Speakers: Wesley Larson and Rolland C. Trudeau, DeBell & Richardson, Inc., "FORMING AND WELDING THERMOPLASTIC SHAPES."

R. L. Butzko, Noma Electric Corp., and E. B. Stratton, Jr., Industrial Radiant Heat Co., "THE VACUUM FORMING PICTURE."

John Gurtowski, Dept. of the Army, "PLASTICS ENGINEERED FOR RELIEF MAP REPRODUCTION."

M. S. Greenhalgh, General Electric Co., "EXTRUSION TRENDS IN VINYL COMPOUNDING."

"FORMING AND WELDING THERMOPLASTIC SHAPES"

●**BIOGRAPHY:** Mr. W. S. Larson graduated from University of Minnesota, receiving a B.M.E. degree in 1939. He worked as product and development engineer for the plastics division of General Electric, 1939-1946. Principal activities were centered around the molding of phenolic plastics,

Wesley Larson

Rolland C. Trudeau

engineering the M-52 mortar fuse, studies of transfer molding, and development of phenolic and polyester low-pressure molding.

He is now affiliated with DeBell & Richardson, Inc., as product and process engineer on new developments. Typical projects are forming of oriented polystyrene, formulation and molding of large pipe fittings, epoxy adhesive developments, polyester molding compounds and laminates, extrusion coatings, etc.

●**BIOGRAPHY:** Mr. R. C. Trudeau attended Massachusetts College of Pharmacy. During World War II worked for Westinghouse doing experimental development on anti-aircraft guns for the Navy.

He joined DeBell & Richardson, Inc., in 1946 and worked in the chemical section until 1947, when he joined the product development group. Has worked on the design and application of the Hot Jet welding gun and is now in charge of all phases of its manufacture and sales. In this work, has done much basic investigation in welding techniques and applications.

●**ABSTRACT:** A short review is made of the types, shapes and applications of thermoplastics which are conventionally formed and welded. Some case histories and slides will be shown and the methods of forming and welding will be demonstrated.

The applications of new thermoplastics and unusual uses of fabricated shapes will also be covered, and the possibilities and economics of this type of production will be discussed. Technical details of the welding operation will be presented.

"THE VACUUM FORMING PICTURE"

●**BIOGRAPHY:** Robert L. Butzko, Chief Engineer, of Noma Electric Corp., a Mechanical Engineer, trained in the prewar period as a machinist, toolmaker, machine tool designer, shop superintendent in the electrical wiring device industry. During the war was chief project engineer on manufacturing of Army, Navy Air Force radar systems. Specialized on heavy bomber radar electronic bombsights. After war was engaged in jet engine research. Presently engaged in charge of design, development, research engineering specializing in consumer products.

R. L. Butzko

John Gurtowski

●**BIOGRAPHY:** E. Bowman Stratton, Jr. His entry into the plastics field was in 1942 when he joined the Plaskon Division of the Libbey Owens Ford Glass Company in Toledo, Ohio. Between 1943 and 1945 he was in charge of the Plaskon office in Washington, D. C., during which period he became familiar with many of the plastic people working on Government projects. Subsequently he did sales and development work on resorcinol formaldehyde resins and adhesives for the Pennsylvania Coal Products Company of Petrolia in Pennsylvania.

In 1947 he became Chief of the Materials Development Section, Relief Map Division, Army Map Service, Washington, D. C. As a result of work on the forming, by heat and vacuum, of preprinted plastic relief maps, he evolved a practical vacuum forming process and fabricating of all thermoplastic sheet materials in a wide range of gauges.

He joined the Industrial Radiant Heat Corporation of Gladstone, New Jersey in 1951, where he entered the field of manufacturing vacuum forming machines. He has now formed a company of his own, the Auto-Vac Forming Company, for producing advanced designs of these machines.

"RELIEF MAP REPRODUCTION"

●**BIOGRAPHY:** Mr. J. J. Gurtowski attended Newark Technical School, 1938; Newark College of Engineering, 1941; Graduate Schools at U. S. Dept. of Agriculture and National Bureau of Standards. He has been employed by Garfield Mfg. Co., and Bendix Aviation Corporation. He joined the U. S. Dept. of the Army in 1951, where he is Chief, Materials Section Relief Map Division.

●**ABSTRACT:** The increased demand for plastic relief maps by the Armed Services and the probable eventual use of relief maps in our educational institutions and in other phases of civilian life emphasize the need for reevaluation of the materials now employed in map production and to overcome the problems resulting from increased production. The plastics industry will be asked to tighten the thickness tolerances and improve the printing surfaces of its plastic sheets. New and better plastic printing inks must be developed for high speed off-set printing. New thermo plastic sheet material must be developed to meet the demand for lower temperature flexibility. Very stable, low-shrinkage, temperature and flame resistant casting resins are needed for producing light-weight library molds from plaster production models. Stable, lightweight fillers and binders are needed for producing temperature-resistant, stable, porous production molds to decrease mold production time. Finally, a casting material is needed to replace the plate glass used in negative drafting. The casting material must produce a cast with the physical properties of the plate glass in addition to its high impact resistance.

"EXTRUSION TRENDS IN VINYL COMPOUNDING"

●**BIOGRAPHY:** Mr. M. S. Greenhalgh was born in Rhode Island and educated at the University of Bridgeport, majoring in chemical engineering. He

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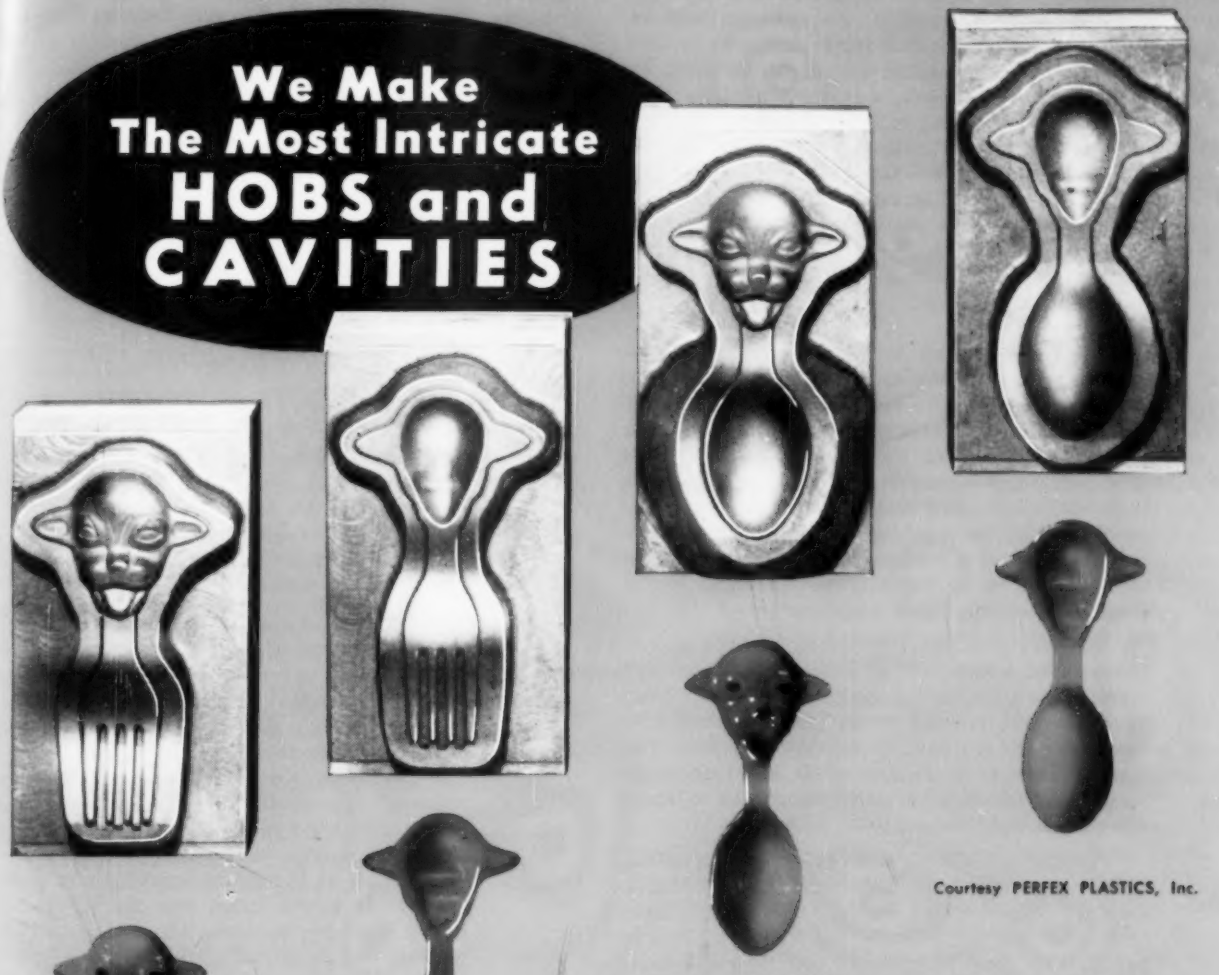

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joined the General Electric Company at Bridgeport, Connecticut, in 1933, and was transferred to the Laboratory in 1935 where today he is Section Engineer in charge of plastics. In 1948, he won the Charles A. Coffin award given by the company for outstanding contributions in advancement of his work. For the past 15 years, he has been Professor of Chemistry at the University of Bridgeport in the Evening Division where he has lectured on plastics and rubbers and conducted classes in chemistry. He is a member of the American Chemical Society and of the Connecticut Section of S.P.E.

●**ABSTRACT:** During the past few years there has been considerable discussion, particularly in connection with the advent of powder mixing, of vinyl compounds. Several resin manufacturers have gone so far as to publish brochures with their recommendations as to the correct technique to follow in extruding vinyl compounds made from powder mix. These publications, if not in agreement, have had a tendency to make for a more open discussion of the extrusion problem which has been beneficial to all concerned.

In 1949, the author prepared a paper on extrusion and attempted to present the need for more efficient processing equipment. Several basic variables were pointed out at that time, and it is interesting to compare these variables from the standpoint of how much progress has been made with those which have been referred to in more recent publications.

In the meantime, new types of materials, such as monochlorotrifluoroethylene, rigid vinyls, elastomeric plasticized vinyls, and so forth, have presented new problems to the industry. This is particularly true of monochloro**trifluoroethylene,** the use of which has necessitated somewhat new and novel techniques in extruding. It is also interesting to note that at a recent conference of a technical society, the research laboratory of a major thermoplastic supplier presented a progress report on a fundamental and basic extrusion study which had been undertaken at their laboratories. This approach was encouraging to a great many persons attending this conference.

12:00 Noon SPE JOURNAL EDITOR'S LUNCHEON

for members of the staff of the SPE Journal

2:00-4:45 p.m. Session A—Bay State Room

Moderator: A. J. Warner, Federal Telecommunications Laboratories

Speakers: To be announced—Research symposium

"RESEARCH SYMPOSIUM"

2:00-3:15 p.m. Session B—Georgian Room

Moderator: Charles W. Kleiderer, Arnold Brilhart, Ltd.

Speakers: Otto Wulfert, Wagner Electric Corp., "PLASTICS PROBLEMS IN ELECTRICAL MOTORS."

C. R. Giannotta, M. W. Kellogg Co., "TECHNIQUES OF INJECTION AND COMPRESSION MOLDING OF POLYTRIFLUOROCHLOROETHYLENE."

"PLASTICS IN ELECTRIC MOTORS"

●**BIOGRAPHY:** Mr. Otto Wulfert, Chief Mechanical Engineer, Electrical Division of Wagner Electric Corporation, joined the company in 1913. He has been in the Engineering Department since 1926. He is a charter member of the St. Louis Section of S.P.E. and has been active in local affairs of the Society.

●**ABSTRACT:** In agreement with the theme of of the conference "Plastics-Engineered for Tomorrow" this paper will deal with designs which have been changed from a metal to a plastic construction with a discussion of the requirements when such changes are made.

The thought of "Plastics-Engineered for Tomorrow" fits particularly well into the electric motor industry where it is difficult because of established designs, established practices, customer acceptance, or just plain opposition to make any change. It is the usual practice of the electric motor industry to make no changes unless the present design is unsatisfactory, even though it is almost apparent that a material such as plastic would answer the purpose and cost less.

When it was suggested that the writer prepare a paper on plastic problems in electric motors, it was recognized that this covered a large field and that it would be necessary to confine the paper to a limited field.

There is, at the present time, an extended use of plastics in electric motors which is far greater than is realized by the ordinary individual. Examples of the present use of plastics will be mentioned in the paper.

The examples shown of changes to plastics

M. S. Greenhalgh

Otto Wulfert

Carmen R. Giannotta

Albert Lightbody

are those which have occurred within the writer's experience, but which should demonstrate the procedure which could be applied to other developments.

"MOLDING TRIFLUOROCHLOROETHYLENE"

●**BIOGRAPHY:** Mr. C. R. Giannotta graduated from Pratt Institute in 1942. Before entering the Navy, he was attached to the Office of Naval Inspector of Ordnance at Eastman Kodak Company. He then went to work for Eastman Kodak Company as Supervisor of the Plastics Laboratory of the Navy Ordnance Division. He recently transferred to the technical service staff in the field of fabricating Kel-F for the M. W. Kellogg Company.

●**ABSTRACT:** A brief discussion of the basic polymers polytrifluorchloroethylene including the forms and grades in which it is presently being produced by the M. W. Kellogg Company, Jersey City, New Jersey, under the trade name KEL-F. An explanation of the No Strength Temperature test for control of the polymer and the fabricated part. A brief description of the physical properties, including electrical, chemical and thermal applications. A thorough discussion of the conditions required for molding and feeding care in the handling of the molding powder and cleanliness of the press and working area with brief remarks concerning mold design for this material. The control of the molding process including temperature, cycle and mold control. The injection molding process with some recommended press and operating conditions and typical cycles and temperatures. The compression, transfer and plunger molding process, including heating and cooling of the mold and variation in the process to obtain efficient cycles.

3:30-4:45 p.m. Session B continued—Georgian Room

Moderator: Dr. Albert Dietz, Massachusetts Inst. of Technology

Speakers: Albert Lightbody, U.S. Naval Ordnance Laboratories, "PLASTICS FOR SURGEONS."

Robert K. Petry, Delaware Floor Products, "VINYL FLOOR COVERING."

"PLASTICS FOR SURGEONS"

●**BIOGRAPHY:** Mr. Albert Lightbody, at present the Chief of the Chemistry Division in the Engineering Department of the Naval Ordnance Laboratory, White Oak, Maryland, did his doctorate work at the University of Nebraska. After two years teaching at the Chadron State Teachers College (Nebraska) he went to the Pigments Division of duPont as a research chemist in white pigments. He left duPont to accept a commission in the Navy, where he was assigned to the Naval Ordnance Laboratory. After release from active duty in 1946, he accepted the position of Chief of the Plastics Division which later was expanded to become the Chemistry Division.

His spare time is taken up with such matters as S.P.E., P.T.A., Naval Reserve and golf.

●**ABSTRACT:** The growing utilization of plastics for every conceivable use throughout the industry had made it inevitable that the surgeons would become very active in this field. Illustrations of the use of plastics in the human body cover almost every part, ranging from bones to arteries and from the head to the feet. Other uses, such as splints, casts, etc., which are aids to the surgeon are becoming common. The properties of plastics which make them of interest to the surgeon range from the coloring possibilities to the non-irritating qualities. The corrosion resistance, the stability in use, the flexibility and its actual resemblance in appearance and properties give to the body repairmen excellent material with which to work.

The permanence of various installations has been in question as many fail rapidly. However, there have been many instances of long-time repair work. At the present time, the data on resistance to body fluids and to the lack of irritation is very erratic, so that prediction as to possible length of usefulness is impossible in most instances.

The prosthetic surgeon has been coming into his own when he has such useful tools with which to work. However, the idea of mass production for these uses is in general less attractive than for the usual plastics items. Casting to shape and machining from stock as well as the use of polyester low pressure forming have been most popular due to (1) that so few of any one design are to be produced and (2) that the necessary tools for fabricating are more rapidly available to the surgical technician.

"VINYL FLOOR COVERINGS"

●**BIOGRAPHY:** Mr. R. K. Petry attended Trenton (New Jersey) Public Schools, and received his B.S. from Rutgers University in 1933. His company associations have been Sloane-Blabon Corporation, 1933-1935; Delaware Floor Products, Inc., 1951 to present.

Mr. Petry is a member of S.P.I., and Federation of Paint and Varnish Production Clubs.

●**ABSTRACT:** The speaker will give the early history of hard surface floor coverings: Linoleum, Printed Felt Base, Rubber Tile, Asphalt Tile. The development of vinyl floorings—early experimental tiles—continuous decorated calendered sheets, and printed types. A description of current types of vinyl floorings.

a. The flexible and semi-flexible solid tiles.
b. The supported calendered vinyl wear layers in sheet and tile form.
c. Printed vinyl floorings.
   1. Clear vinyl wear layers over a rotogravure printed design.
   2. Vinyl print paint on asphalt saturated felt.

Robert K. Petry

Regarding future growth, the following points will be made:

a. Advantages of vinyls in finished product quality and ease of processing.
b. Versatility of vinyls in application to all types of hard surface flooring products.
c. Adaptation to existing processing equipment.
d. Price stability of raw materials.
e. The low capital investment.

6:30 p.m. BANQUET—Main Ballroom

Speaker: The Countess Maria Pulaski—Dinner Music and dancing

THE COUNTESS MARIA PULASKI—FAMOUS WOMAN SPY

FRIDAY, JAN. 23

9:00-10:15 a.m. Session A—Bay State Room

Moderator: Islyn Thomas, Newark Die Company
Speakers: Gregory J. Azarian, American Brake Shoe Co., "MOLD CASTINGS."
Arthur W. Logozzo, Nutmeg Chrome Co., "CHROME PLATING PLASTICS MOLDS."

"MOLD CASTINGS"

●**BIOGRAPHY:** Mr. G. J. Azarian graduated from Massachusetts Inst. of Technology in 1943. He enlisted in U. S. Navy, served as Motor Torpedo Boat Skipper in Pacific, and was separated in 1945 with Silver Star and Navy Unit Commendations. From 1945 to 1947, he was employed as Research Metallurgist at Pratt & Whitney Aircraft. In 1947, he joined the American Brake Shoe Company as Research Metallurgist and for the past three years has been Sales Engineer of the Engineered Castings Division. He is a member of ASM.

●**ABSTRACT:** A brief resume of technical phase of precision castings will be given. The metal analyses being cast and what has been learned concerning advantages and disadvantages of different analyses, heat treatment, polish, etc. Types of plastics articles the molds are now being used for:

1. Fiberglass
2. Novelties
3. Specialized industrial
4. Hot hobbing of Be. Cu.
5. Actual cores and cavities.

Discussion of the advantages of iron and alloyed iron castings, as to price, delivery, weldability, casting consistency, etc. Future prospects for precision iron and alloyed iron molds and metals being considered.

Gregory J. Azarian

Arthur W. Logozzo

"CHROME PLATING PLASTICS MOLDS"

●**BIOGRAPHY:** Mr. Arthur W. Logozzo has been in the plating field for twenty-three years, having worked for Connecticut Telephone and Electric Co., International Silver Company, Pratt-Whitney, General Electric Co., and MacDermid, Inc.

In 1944, he founded the Nutmeg Chrome Corporation and has been its president ever since.

He is a past national president of the American Electroplaters Society and has lectured all over the United States and Canada and written articles for many trade journals.

●**ABSTRACT:** This talk will bring plating thicknesses for various materials up-to-date. A brief discussion on hydrogen embrittlement through mold plating; what the mold maker should know about the plating operation; advantages of plating molds; and, winding up with a color movie on mold plating and polishing.

9:00-10:15 a.m. Session B—Parlors A, B and C.

Moderator: Frank A. Rideout, Bakelite Co.
Speakers: Dave Birmingham, Colt's Mfg. Co., "REINFORCED POLYSTYRENE IN AIRCRAFT."
A. P. Landall, General Electric Co., "ENGINEERING DESIGN FOR RUBBER PHENOLICS."

"ENGINEERING DESIGN FOR RUBBER PHENOLICS"

●**BIOGRAPHY:** Mr. A. P. Landall has worked for General Electric since shortly after his graduation from Northeastern University in 1939 with a degree of Bachelor of Science in Chemical Engineering. He worked on the initial developments of decorative laminates for the General Electric Company, as well as factory trouble-shooting on general laminating problems. The next four years were spent on thermoplastic development and the application of thermoplastics to the various problems encountered within the General Electric Co. This period also included some time spent in thermosetting development. The next three years were spent as Materials Engineer on phenolic products and following that assignment, he became Application Engineer for phenolic molding materials for the Chemical Materials Department. In this job, he has been held responsible for technical service on molding materials and analysis of the various application problems that have been submitted to his department.

●**ABSTRACT:** The background of the rubber-phenolic compounds along with their standard physical characteristics will be discussed briefly. Mold design data will be stressed including mold shrinkage, types of molds for various applications with special attention to shrinkage, dimensional tolerance, warpage, and surface finishes.

The speaker expects, by the aid of slides, to illustrate the various points brought out on the

talk by showing actual applications of rubber-phenolic molding materials, together with the design data which made them successful and the product story regarding the economies and the reasons for using this type of material in place of other materials of construction, including die casting.

10:30-12:00 Noon Session A—Bay State Room

Moderator: Walter F. Oelman, Standard Molding Corp.

Speakers: Members of SPE Professional Activities Committees

"BASIC FACTS ON PLUNGER AND TRANSFER MOLDING"—Sanford E. Glick and Frank J. Donohue, Monsanto Chemical Co., Edward W. Vaill, Bakelite Co., and Edward F. Borro, Durez Plastics & Chemicals, Inc.

"MULTI-SCREW EXTRUSION OF POLYVINYLCHLORIDE"—S. H. Greenwood, F. J. Stokes Machine Co.

"ELECTROSTATIC PROPERTIES OF RUBBER AND PLASTICS" — H. A. Endres and Ward T. Van Orman, Goodyear Tire and Rubber Co.

"BASIC FACTS ON PLUNGER AND TRANSFER MOLDING"

●**BIOGRAPHY:** Mr. S. E. Glick graduated from M.I.T. in 1941 with a B.S. degree in Chemical Engineering. Upon graduation, he was employed by the Monsanto Chemical Company and spent five years in research working on the development of styrene polymers and copolymers. In 1946, he entered the Thermoplastic Molding Materials Technical service and was manager of this department until April 1952, after which he became Assistant Sales Manager of the Thermoplastic Molding Materials Sales Department.

He was chairman of the S.P.E. Professional Activities Committee in 1951 and in 1952 has been Co-Chairman of Area I. He has also served on numerous S.P.I. committees.

●**BIOGRAPHY:** Mr. E. W. Vaill is a graduate of Colgate University, 1932, having taken a Major in Physics and a Minor in Math. In 1939, he took a course at Massachusetts Institute of Technology in Industrial Chemistry and Plastics.

He joined the Bakelite Company in 1932, and after taking a 2½ year training course in the plant, was engaged at the New York office for promotional work for plastic containers in the packaging field. He also had charge of all technical "Bakelite" exhibits and participated in Industrial Shows throughout the country.

In 1937, he was transferred to the Hartford office where his duties were technical service and sales of "Bakelite" molding materials in the New England area. He is now in charge of the Hartford Sales Office and Senior Technical Representative for that area, handling both "Bakelite" and "Vinylite" products in the molding and extrusion field.

He served as Director of the Western New England Section of S.P.E. from 1948 through 1950, and President of this Section in 1950.

●**ABSTRACT:** "Basic Factors in Plunger and Transfer Molding." A discussion of preheating techniques by radio frequency, infra red, steam oven, and dry oven methods, will be given. This discussion will include preform sizes, density and positioning with a demonstration using a radio frequency preheaters.

"CLOSED MOLD MOLDING TECHNIQUES"

●**BIOGRAPHY:** Mr. E. F. Borro, Service and Development Engineer, of Durez Plastics and Chemicals, Inc., is a member of the S.P.E. Buffalo Section, and a member of S.P.I. He is a pioneer in the plastics industry being identified with it in its early days.

●**ABSTRACT:** "Closed Mold Molding Techniques." A discussion of the elements involved in the successful use of closed mold molding. These are (1) practical part design; (2) selection of the right material; (3) mold design; (4) size of gate and runner; (5) position of gates; (6) transfer and clamping pressure. Pertinent data on dimensional stability and accuracy, mold wear, and the effects on physical and electrical properties in transfer or plunger molding are also included in the discussion. Slides illustrating the various points will be used.

"EQUIPMENT AND MATERIALS FOR TRANSFER MOLDING"

●**BIOGRAPHY:** Mr. F. J. Donohue, former President of the Western New England Section of S.P.E. received his B.S. degree in 1927 and Chemical Engineering degree in 1930 from the College of the City of New York.

He was employed for two years by the Bakelite Corporation and the following two years as

A. P. Landall

Sanford E. Glick

Frank J. Donohue

Edward W. Vaill

an instructor in General Chemistry at the College of the City of New York. He joined the Resinox Corporation in 1934. This became a part of the Plastics Division of Monsanto Chemical Company in 1939. At present, Mr. Donohue is Manager of Technical Service on thermosetting molding materials in the Plastics Division of Monsanto Chemical Company.

●**ABSTRACT:** "Equipment and Materials for Transfer Molding." Transfer molding is carried out today principally in auxiliary ram presses. Some pot type transfer molding is still done, utilizing three-plate molds in straight compression presses.

Newer transfer or plunger molds are compactly arranged, in radial layouts, where possible, and with short runners. Preheating, either dielectric or steam, is a "must" with this type of molding operation.

Phenolics, in particular are, as a class, well suited to plunger molding. Special formulations, having rapid flow rates at moderate molding pressures, have been developed for this use. Melamine materials also show good transfer molding behavior, although some modification of the basic resin may be necessary to obtain best results. Ureas are generally not well suited to this operation, particularly, in the production of large parts, because of their reactivity.

Molding material composition vitally affects transfer performance of phenolics. Important factors are the following:

Resin type and reactivity
Resin content
Type and amount of filler
Moisture content

Other important factors are mold design and molding conditions, including the following:

Gate size and shape
Runner area
Mold temperature
Preheating procedure.

10:30-12:00 Noon Session B—Parlors A, B and C.

Moderator: Sherwood L. Young, C. F. Church Mfg. Co.

Speakers: Frank W. Reynolds, International Business Machines, "USE OF PLASTICS IN BUSINESS MACHINES"

W. L. Gore, E. I. duPont de Nemours & Co., Inc., "SOME PRINCIPLES OF PLASTICS SCREW ESTRUSION."

J. F. Carley, E. I. duPont de Nemours & Co., Inc., "OPERATING CHARACTERISTICS OF EXTRUDERS."

J. M. McKelvey, E. I. duPont de Nemours & Co., Inc., "DESIGN OF A SCREW FOR PLASTICS."

"PLASTICS IN BUSINESS MACHINES"

●**BIOGRAPHY:** Mr. F. W. Reynolds, Manager of the Plastics Research Laboratory of International Business Machines Corporation, spent his first ten years with the company as a machine designer. He has been in the plastics laboratory for the past ten years. He has been an instructor in plastics materials and mold design for the IBM educational system since 1943. He also taught in Cornell University Extension during World War II. He has lectured to various technical groups and service clubs on plastics materials and applications. He is a member of S.P.E. and S.P.I.

●**ABSTRACT:** The nature of the use to which plastics are put in these products demands extreme precision, a minimum of dimensional change due to temperature and humidity variations and a maximum wear life. IBM is now using at least 17 different plastic materials which are fulfilling these requirements. There are four independent factors related to the satisfactory molded item. They are:

1. Good part design.
2. Correct material choice.
3. Proper type of mold and mold design.
4. Experienced molding technique.

A violation of any of these will result in an unsatisfactory part. Adherence to all will be well rewarded.

"PRINCIPLES OF PLASTICS SCREW EXTRUSION"

●**BIOGRAPHY:** Mr. W. L. Gore received his M.S. in Phys. Chem. from the University of Utah in 1935. He was with the American Smelting and Refining Company and Remington Arms Company before joining duPont Company (Plastics and Polychemicals Departments) in 1945. He is now Senior Supervisor of Plastics and Elastomer Processing, Polychemicals Department, Research Division.

●**ABSTRACT:** The operational principles of a plastics extruder are described in general terms and the equation of calculating output, pressure, and power are given. The principles of scaling up from small to large extruders are discussed and

Edward F. Borro

Frank W. Reynolds

W. L. Gore

J. F. Carley

the "cube" rule given for geometrically similar extruders. The nature of the operating characteristic curve for extruders is discussed.

"OPERATING CHARACTERISTICS OF EXTRUDERS"

●**BIOGRAPHY:** Mr. J. F. Carley received his Ph.D. from Cornell University in 1950. He joined the duPont Company, Polychemicals Department, and is now a Research Chemical Engineer in the Research Division.

●**ABSTRACT:** Operating characteristics for screws and dies of extruders are defined and the connection between them explained. Several different screws are described with emphasis on the sort of characteristics they can be expected to have. Data giving the actual characteristics during extrusion of "Alathon" and "Lucite" resins are presented and interpreted. Some conclusions are drawn regarding the types of screws needed to do different extrusion jobs.

●**BIOGRAPHY:** Mr. J. M. McKelvey received his Ph.D. in Chem. Engineering from Washington University, St. Louis, in 1950. He was an instructor in Chemical Engineering at Washington University from 1947-1950. He joined the duPont Company in 1950 and is a Research Engineer in Plastics Processing, Polychemicals Department.

J. M. McKelvey

●**ABSTRACT.** The actual calculations of the dimensions of a screw for a specific plastics extrusion job are outlined. The basis of the calculations are discussed and the approximations involved are described. Performance data are cited for several different designs of extruders.

12:00 Noon **LUNCHEON**—Main Ballroom

Feature Speaker: General Doroit, President National Research & Development Corp.

General Georges Frederic Doriot is famous for the Doron Plastic, named for him, which was developed by the Quartermaster Corps for armored vests during World War II.

He is eminently qualified to speak before a plastics group since some of the foremost companies listed under American Research and Development Corp., of which General Doriot is President, are plastics manufacturers, chief among which are Carlon Products Corporation of Cleveland, Ohio; Snyder Chemical Corporation, Bethel, Connecticut; American Polymer Corporation and American Resinous Chemicals Corporation, Peabody, Mass.; and American Monomer Corporation of Leominster, Mass.

A suggested title for General Doriot's talk is "Let's Take a Sharp Look."

General Doriot, a naturalized American, was born in Paris. He holds the following military honors: C.B.E. (Commander, Military Order of the British Empire); D.S.M. (Distinguished Service Medal, United States of America); O.L.H. (Officer of the Legion of Honor).

His background may be tabulated as follows: Brigadier General, U. S. Army — ORC — Assigned to General Staff, G-4; Harvard Graduate School of Business Administration—Professor of Industrial Management; American Research and Development Corporation—President; Director of several American Research affiliates—American Research and Development Corporation, Director; John Hancock Mutual Life Insurance Company, Director; National Shawmut Bank, Director; Pressed Steel Car Company, Director; Eagle-Ottawa Leather Company, Director; Federal Machine & Welder Company, Director; American Arbitration Association, Director, N.Y.C.; Institute of Contemporary Art, Member of the Corporation; N.E. Chapter, Arthritis & Rheumatism Committee, Trustee.

Government Service: Director, Military Planning Division, OQMG (Research and Development, Requirements, Operations, Material Control, Production Planning, Production Scheduling). Deputy Director, Research and Development, War Department. Deputy Administrator, War Assets Administration. Present Assignment — Assistant Chief of Staff, G-4, Department of the Army. Lecturer, Army Industrial College.

2:00 p.m. **OPEN FORUM**—Parlors A, B and C

Moderator: Sherwood L. Young, C. F. Church Mfg. Co.

Speakers: All of conference speakers are invited to constitute a panel to answer questions from the floor.

Biographies of the Session Moderators

Mr. Istyn Thomas attended the University of Scranton and Columbia University. He taught plastics and mold design at Polytechnic Institute of Brooklyn and wrote the book entitled "Injection Molding of Plastics." He was president of Thomas Manufacturing Corp. and is General Manager of Newark Die Co. He was national president of S.P.E. for 1951, and is still a member of the board of directors of the Society.

Mr. Walter F. Oelman attended the University of Illinois and the Harvard Business School. After nine years in the real estate management field, he entered the employ of the Standard Molding Corporation, where he is now Vice-President and General Manager. Always active in community work, he is a member of Dayton's Rotary Club and treasurer of the City of Oakwood Adam Schantz Sr. Corp. and vice president of the Reliable Fire Insurance Co. He is national vice president of S.P.E. for 1952.

Mr. Sherwood L. Young is vice president of C. F. Church Mfg. Co. He joined the company in 1928 at their Washington, N. J. plant in the cost department. He became plant manager of their molding division at Monson when the division was set up. He has been active in the local section of S.P.E. and is a national director of the Society.

Ladies Program Announced for the Ninth Annual SPE Conference

JANUARY 21, WEDNESDAY

Get Acquainted Party (Hancock Room) ..... 1:00 p.m.— 2.00 p.m.

Hit Stage Show at Boston Theater ..... 2:00 p.m.— 5:00 p.m.

JANUARY 22, THURSDAY

Seeing Historic Boston and Charleston (Guided tour in heated glass-domed busses) ..... 9:00 a.m.—12:00 p.m.

Luncheon (Parlors A and B) ..... 1:00 p.m.— 2:30 p.m.

Speaker—Mr. Frank Kiefer, Editor
Department Store Economists
New York, New York

Mr. Kiefer will tell how to get the most for your money in buying plastics.

Fashion Show at Leading Department Store ..... 2:30 p.m.— 4:00 p.m.

Ladies cordially invited to attend the banquet in the evening. ..... Dress is semi-formal.

JANUARY 23, FRIDAY

A Conducted Tour Through Victory Plastics ..... 9:00 a.m.—12:00 p.m.

Hudson, Massachusetts to see manufacture of plastic articles

Luncheon ..... 1:00 p.m.

We wish to point out that the ladies' registration fee of $5.00 covers their complete program with the exception of the Banquet.

GENERAL ELECTRIC COMPANY PLASTICS ALUMNAE REUNION

A reunion dinner is planned in connection with the Ninth Annual Technical Conference of S.P.E. at the Hotel Statler, Bay State Room, Boston, Massachusetts, January 21st, 1953 at 6:30 p.m.

All present and past employees of the General Electric Company Plastics Operations are invited to attend this informal get-together. A large effort is being made to reach all the old timers for this reunion.

Please send in your reservation to Mr. Mel Haas, Bolta Products, Incorporated, 161 Canal Street, Lawrence, Massachusetts. Your help is invited to spread the news of this meeting so that a maximum attendance will result. The large and diversified interests of this group will certainly result in an interesting meeting.

Company Registration at the Ninth Annual Conference

The following companies had registered for the 9th SPE Annual Conference before December 1, 1952.

MOLDERS, MOLDMAKERS, TOOLS AND DIES

A. & M. Tool & Die Co., Southbridge, Mass.
Autograph Brush & Plastics Co., Inc., Watervliet, N. Y.
Bolta Co., The, Lawrence, Mass.
Carlon Products Corp., Cleveland, Ohio
Celluplastic Corp., Newark, N. J.
Chippewa Plastics, Inc., Chippewa Falls, Wisc.
Colt's Mfg. Co., Hartford, Conn.
E. L. Cournand & Co., Inc., New York, N. Y.
Foster-Grant Co., Inc.
Fuller Brush Co., Inc., Hartford, Conn.
Michigan Plastic Products, Inc., Grand Haven, Mich.
Northern Industrial Chemical Co., South Boston, Mass.
Plax Corp., Hartford, Conn.
Prolon Plastics (Prophy-lac-tic), Florence, Mass.
Renwal Mfg. Co., Mineola, N. Y.
Rogers Plastic Corp., West Warren, Mass.
Shaw Insulator Co., Irvington, N. J.
Sunlite Mfg. Co., Milwaukee, Wisc.
Victory Plastics Co., Hudson, Mass.
Vulcanized Rubber & Plastics Co., Morrisville, Pa.
Waterbury Companies, Inc., Waterbury, Conn.

MACHINERY AND HEAVY EQUIPMENT

Fellows Gear Shaper Co., Springfield, Vt.
F. J. Stokes Machine Co., Philadelphia, Pa.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Improved Paper Machinery Corp., Nashaw, N. H.
Industrial Mfg. Corp., Indianapolis, Ind.
Lester Engineering Co., Cleveland, Ohio.
Manco Products, Inc., Melvindale, Mich.
Modern Plastic Machinery Corp., Lodi, N. J.
National Rubber Machinery Co., Akron, Ohio.
Sterling, Inc., Milwaukee, Wisc.
W. T. LaRose & Assoc., Inc., Troy, N. Y.

MATERIALS

American Cyanamid Co., New York, N. Y.
American Molding Powder & Chem. Co. (A. Bamberger), Brooklyn, N. Y.
B. F. Goodrich Chemical Co., Cleveland, Ohio.
Catalin Corp. of America, New York, N. Y.
Celanese Corp. of America, New York, N. Y.
Dow Chemical Co., Midland, Mich.
Durez Plastics & Chem. Co., North Tonawanda, N. Y.
E. I. DuPont deNemours & Co., Inc., Wilmington, Dela.
General Electric Co., Pittsfield, Mass.
Hercules Powder Co., Wilmington, Dela.
H. Kohnstamm & Co., Inc., New York, N. Y.
H. Muelstein & Co., Chicago, Ill.
Koppers Co., Inc., Pittsburgh, Pa.
Monsanto Chemical Co., Springfield, Mass.
M. W. Kellogg Co., Jersey City, N. J.
Naugatuck Chemical, Naugatuck, Conn.
Plaskon Div., Libby-Owens-Ford Glass Co., Toledo, Ohio
Rogers Corp., Manchester, Conn.
Rohm & Haas Co., Philadelphia, Pa.
Tennessee Eastman Co., Kingsport, Tenn.

Management Looks at the SPE

Edward J. Pechin

E. I. DuPont de Nemours & Co.

It seems to me that the strength of the SPE lies in its individual chapter meetings. Constructive, well-represented meetings make real contributions to the industry generally and keep up the health of the organization itself. History has shown that organizations and business progress thrive on meetings of this kind.

From all reports, the chapter meetings of the SPE are well attended and attract active participation by companies in the plastics industry. This, in itself, is an indication of the worth of the proceedings at these meetings. Thus, if this viewpoint is recognized by the voluntary officers who serve the chapter organizations, and by their associates in their own businesses, the strength and creativeness of these meetings will grow.

From such exchange of ideas and information in many places, among many groups, stems the broad perspective for selecting pertinent subjects for such successful annual conferences as those held by the SPE. It can be concluded, therefore, that the SPE is serving a vital need in the plastics industry. The Society will undoubtedly continue to grow as the dynamic plastics industry grows.

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THE CONFERENCE COMMITTEE FOR THE NINTH SPE ANNUAL TECHNICAL CONFERENCE

Left to right—rear row, standing: Frank C. Dooley, Chairman of Publicity and Advertising; Arthur A. Staff, Sgt. at Arms; Arthur Logozzo, Speakers Committee Chairman; Alternate for Louis J. Pentland, Grayson W. Wilson, Assistant Chairman of Reception Committee; Richard Bruce, Chairman of Favors and Door Prizes; Robert Davenport, Chairman of Prize Papers Committee; Raymond A. Mazur, Chairman of Printing Committee; Frederick H. Langhorst, Chairman of Ladies' Entertainment.
Left to right—front row, seated: George W. Martin, Chairman of Company Registration; James F. Lang, Co-Chairman John W. LaBelle, General Chairman; Melvin S. Haas, Secretary; Jack G. Fullmer, Jr., Chairman of Registration, Reservation, and Information Committee; John T. Moore, Chairman of Program Committee.
(Absent—1 chairman—Mr. Richard Beckwith, Treasurer.)

●**BIOGRAPHY:** John W. LaBelle, district sales manager of Koppers Company, has held at one time or another all offices in the Eastern New England Section of S.P.E., and all offices in the Boston Providence Chapter of S.P.E. He is at present National Secretary of S.P.E. He is also on the Board of Directors of S.P.I., a member of the Fellowship Committee of the New England Paint, Varnish and Lacquer Association, the Chemical Club of New England, and vice-president of the Northeastern University Alumni Association and Chairman of the Alumni Fund. He earned his degree in chemical engineering at Northeastern University in 1932.

●**BIOGRAPHY:** John T. Moore is a sales representative for Tennessee Eastman Company, and is a member of S.P.E. and S.P.I. He has a degree in chemical engineering from Johns Hopkins University (1941) and served 4 years in the European theater as Captain, Corps of Engineers, Army.

●**BIOGRAPHY:** Arthur A. Staff of Koppers Company, has worked 6 years in the plastics industry, both in production and sales. He has been associated with Chemaco Corp., Alden Products, and JADA Plastics Company. He has an A.B. degree from Brown University. He served over five years with the Army in the Pacific and Asiatic areas. He is a member of S.P.E. and S.P.I.

●**BIOGRAPHY:** Frank C. Dooley, chairman of publicity committee, is Branch Manager of Plastics in New England for the H. Muehlstein and Company, Inc. He is a member of S.P.E., S.P.I., the Rhode Island Rubber Group, the Boston Rubber Group. He earned the Silver Star, European Ribbon with Three Battle Stars while serving as Interpreter with the 44th Infantry division in Europe. He has attended Holy Cross College, where he earned an A.B. honors degree in History, and Boston College Law School, and Boston College Summer School, as well as the University of Nebraska.

●**BIOGRAPHY:** Melvin S. Haas, Secretary to Conference Committee, has been 12 years in the plastics industry. Presently with the Bolta Company as supervisor in charge of the Finishing Department for finishing operations in vinyl sheeting, he has worked for General Electric, Laminated Products Division, and as product engineer on low pressure polyesters molding boats for the Winner Manufacturing Co. He has the B.S. degree in mechanical engineering from Tufts College. He has served as an officer and member of the board of directors of the E.N.E. Section of S.P.E.

●**BIOGRAPHY:** Jack G. Fuller, Jr., Chairman Registrations, is a sales representative for the Hercules Powder Company. Prior to this he worked as a chemist with Hercules, and with Master Plastics. A member of S.P.E., he served over three years military service in Hawaii and Japan. He earned his B.S. degree at Dickinson College, Pennsylvania.

●**BIOGRAPHY:** Richard H. Bruce has been with the Bakelite Company for 12 years, and is presently in the Hartford District Sales Offices. From 1936 to 1941 he lectured on Industrial Chemistry at the Franklin Institute, Philadelphia. A National Director and member of the Executive Committee of SPE, he has also served as

Secretary, and as President, of the Rhode Island and Southeast Massacuhsetts Section of SPE. He is also a member of the SPI, and the Hartford Sales Executives Club. He holds an A.B. in Chemistry from Temple University.

●**BIOGRAPHY: Robert C. Davenport graduated** from Harvard in 1944. Besides $3\frac{1}{2}$ years of military service in the Asiatic-Pacific theater, he has worked for 11 years in the plastics industry. He has been assistant technical director of Sinchemco, Peiping, China, and has worked as a chemist with companies in the United States. At present he is a sales representative, and a member of the American Chemical Society, the Association of Harvard Chemists, and the SPE.

●**BIOGRAPHY:** Mr. James F. Lang, Co-chairman of the 1953 conference committee, is a technical representative for the Bakelite Company, a division of Union Carbide and Carbon Corp. He has a bachelor's degree in chemical engineering from the University of Minnesota. He has been the secretary for the Eastern New England Section of SPE and is the 1952 section president.

●**BIOGRAPHY:** Mr. George W. Martin, Company Registration Chairman of the 1953 conference committee, is general manager of the plastics division of Noma Electric Corp. He started with Noma nine years ago as a plant engineer. He has been a director and the secretary for the Western New England Section of SPE.

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●**BIOGRAPHY:** Mr. Frederick H. Langhorst, Ladies' Entertainment Chairman of the 1953 conference committee, is the Eastern New England representative of the Stanley Chemical Co. He has been in rubber and plastics for the past twenty-two years, having been with Weymouth Art Leather Co. and Hodgman Rubber Co. prior to his present position. He is vice president of the Eastern New England Section of SPE.

●**BIOGRAPHY:** Mr. Raymond A. Mazur, Printing Committee Chairman of the 1953 conference, is a sales engineer for American Cyanamid Co. He has a bachelor's degree in chemistry from Manhattan College. He has been in the industry ten years, having worked previously for Sylvan Plastics, Inc., American Cystoscope Makers, Inc., Optifluor Laboratory.

Industrial Literature

Witco Bulletin On Phthalate

A technical service report describing the uses and properties of **Dibutyl Phthalate** is now available from the Witco Chemical Company.

Dibutyl phthalate is also used in polystyrene, polymethyl methacrylate, natural and synthetic rubbers, chlorinated rubbers, alkyd and plasticizing type synthetic resins and phenolic resin laminating varnishes.

For copies of Technical Service Report E-4, write to Witco Chemical Company, 295 Madison Avenue, New York 17, New York.

Booklet Aids Designer, User Of Molded Plastic

Helpful information and counsel for designers and molders of plastic products are contained in a new four-color 12-page booklet on Plexiglas acrylic plastic molding powder.

Illustrations show applications and designs for products and uses in such fields as household appliances, automobiles, signs, lighting, glazing and industrial parts. Properties discussed include the material's clarity, dimensional stability, dielectric strength, chemical resistance, impact resistance, and machinability.

Text and illustrations apply to both injection-molded and extruded parts. Two pages are devoted to a tabulation of data on the physical optical, electrical and chemical properties of Plexiglas molding powders. The booklet is available on request, without charge, from the Plastics Department, Rohm & Haas Company, Washington Square, Philadelphia 5, Pa.

MECCO SAFETY MARKING TOOLS DESCRIBED IN NEW CATALOG

Over one hundred different marking tools and devices are described and illustrated in the new 28-page **Mecco Safety Marking Tool catalog** published by M. E. Cunningham Company, Pittsburgh, Pa. This brochure includes photographs of the various products; descriptive material; catalog numbers; and in cases where the information applies, charts of the various sizes.

The basic groupings of products in this catalog are as follows: stamps—made to order hand stamps, inspection and symbol stamps, letter and figure stamps, mold stamps and press stamps; marking machines and fixtures; special marking outfits; press and hand type holders; dies and die inserts; engineers and inspection hammers; and steel type.

Copies of this catalog, No. 100, may be obtained from M. E. Cunningham Company, 1025 Chateau Street, Pittsburgh 33, Pa.

TENSILE IMPACT PROPERTIES

INTRODUCTION

The standard tests for mechanical properties of plastics have been derived from the traditional tests for metals. Tests of such properties as tensile strength, flexural strength and impact strength performed under the existing standards yield data useful in the design of structural components when the applied service loading is similar to the test conditions. All too often the assumption is made that the test data can be used for applications subjected to loading or environmental conditions which differ radically from the test conditions.

In transposing the mechanical tests from metals to plastics few changes have been made. Since plastic materials are very different from metals, tests performed by these methods do not give all the desired data. Efforts to correct this situation have, to date, taken the form of devising additional tests specifically for plastics which when considered in conjunction with the traditional tests yield information which can be used for design purpose. Unfortunately this approach leads the materials engineer to think of plastic properties in comparison with the older materials, the net result being that plastics are often applied as substitutes for other materials rather than as materials being applied for their own unique properties.

Considering the problem of the physical properties of plastics from a detached point of view one immediately sees that the important features of these materials are their time and temperature sensitivity. Obviously any physical test for these materials should not only take these factors into consideration but should so measure their effects as to permit the constructive utilization of these features. Some form of dynamic tests seems to be indicated.

Impact tests are sometimes refered to as dynamic tests but if they are performed only at one specific velocity and one specific temperature they yield no more data about the time and temperature sensitivity of the material than a standard slow speed flexural test. The impact properties of plastics are important to the design engineer for two reasons. On the one hand he needs to know the minimum impact strengths of the weaker materials so that he can design against accidental failure. On the other hand he needs to know the impact resistance of the stronger materials so that he can use them in the design of components as impact resistors where high speed blows are expected. Measurements of the strength of these materials over a wide range of rates of straining and temperature are needed.

The history of impact testing of plastics has been reviewed in an earlier paper[1]. The present work might be described as a continuation or extension of this work. Results similar to those obtained for polymethyl methacrylate in tension impact at various rates of straining and temperatures have been obtained for several additional polymers. These results are interpreted for use as engineering design data and also used to obtain a more fundamental understanding of the effect of polymer structure on impact strength.

BASIC THEORY

The energy that a specimen can absorb in tensile impact test depends on the load deformation curve. The area under this curve is a direct measure of the energy required for failure. In general, thermoplastics exhibit a load deformation curve similar to (A) in Fig. 1[1] at low rates of straining. As the load is applied there is a small elastic deformation followed by a yield and plastic flow. At the point (A) failure begins and the crack grows through the specimen cross section until it has completely failed at point (2). At higher rates of straining the load deformation curves change in shape similar to (B) and (C) until at very high rates of straining essentially linear load deformation curves similar to (D) are found.

The area under these curves depends on several factors, the more important of which are the load at the yield point, the load during the region of plastic flow, the deformation at which failure starts and the amount of energy required to propagate the crack across the specimen cross section. Each of these factors will be considered in detail.

The slope of the first portion of the curve depends on the force required to bend the bond angles of the polymer chains. Since this type of deformation is not time dependent the slope of this part of the curve does not depend on the rate of straining.

The load or stress at the yield point depends on the force required to uncoil polymer chains at the rate determined by the rate of straining applied to the specimen. This is a time dependent process. The higher the rate of deformation the greater the force required to uncoil the chains at this rate.

Once the yield point is reached a distinct reduction takes places locally in the cross sectional area of the specimen and true plastic flow occurs. The amount of stress required to produce this flow at the applied straining rate depends on the force required to slip chains past each other. The higher the rate the greater the force required. This load is of course dependent on the cross sectional area.

The amount of energy required to propagate the crack across the specimen section is measured by the area A-1-2. (Fig. 1) As the rate of strain-

S OF SOME PLASTICS

Bryce Maxwell
J. P. Harrington, Robert E. Monica
Princeton University

ing is increased this energy seems to decrease. This decrease is partly due to the increased rate causing the crack to propagate across the specimen more rapidly and to the added amount of elastic energy stored in the specimen at the higher rates of straining. This added elastic energy is released when the failure starts and thereby assists in propagating the crack. Measurements of the tensile impact strength can be corrected by not including the area A-1-2 for this energy to propagate (3) the crack if it is felt that this is not a part of the tensile impact energy measurement.

A theoretical approach indicates that as we increased the rate of straining we should find two distinct breaks in the energy curve. One associated with the polymer molecule chain uncoiling mechanism and one associated with the chain-chain slipping.

RESULTS AND DISCUSSION

The points plotted on the various graphs are usually the average of two to five tests. In the medium velocity range these points are nearly always the average of three tests, although in a few cases, five or more tests were performed and averaged. In the low velocity range, the plotted points are usually the average of two or three points. For the highest velocity range, the points were determined by averaging from three to ten tests since a considerable amount of scatter in the energy values was sometimes found at the highest rates of straining.

The results of tests at 30, 50, 70, and 90°C are plotted vs. log. rate of strain for polymethyl methacrylate in Fig. 2, 3, 4. The specimens used for these tests were machined from a commercially molded $\frac{1}{8}$" thick sheet.

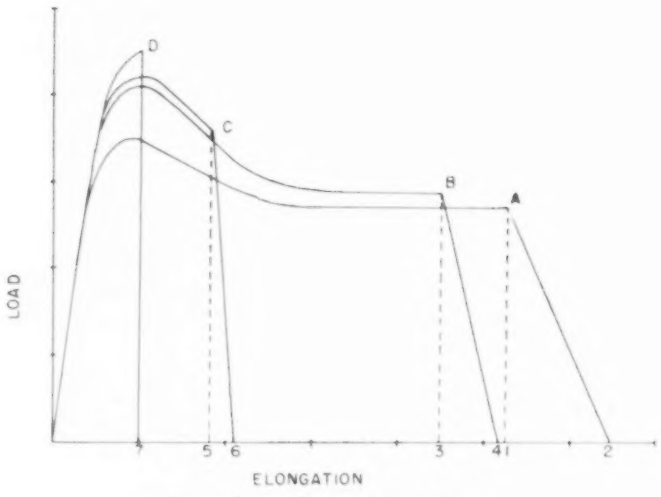

Figure 1. Load Deformation Curves

It was observed from the load deformation curves that extremely little energy was used up in propagating the crack across the specimen once it had started. Therefore we can assume that the energy measured is almost entirely made up of the elastic and plastic energy absorbed by the specimen.

In Fig. 2 the maximum load vs. log. rate of strain is plotted. At each temperature it is seen that the maximum load increases linearly with the log. rate. This is the usual trend found in such materials and is to be expected since the breaking phenomena is time dependent. As the straining rate increases a higher stress is reached since it takes a definite time for the failure to take place.

The elongation at break as a function of log. rate of straining is shown in Fig. 3 for the various temperatures. No linear relationship exists here but there is a general trend to lower elongations as the rate of straining increases. The energy absorbed is dependent on both the elongation and the load and since the load increases with increased rates of straining and the elongation decreases we should not expect to find a simple relation between energy absorbed and rate of straining.

In Fig. 4 we have the results of the tensile impact tests on methyl methacrylate plotted as energy to break vs. log. rate of straining. We see two distinct drops in the energy scale as we progress up the log. rate scale. Considering the 70°C curve, it starts out on a plateau of high energy at low rates of straining and at about 0.01 inches per sec. there is a sharp drop corresponding to the maximum rate of chain-chain slipping or plastic flow. Above this rate there is a plateau of moderate energy followed by another drop which corresponds to the maximum rate of chain uncoiling. Following this drop

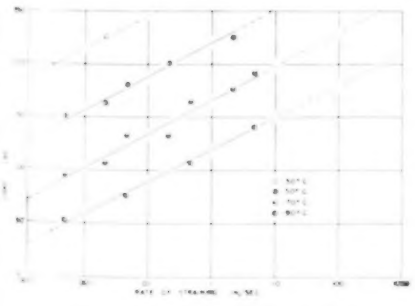

Figure 2. Load vs. Rate of Strain

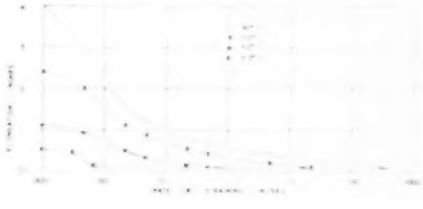

Figure 3. Elongation vs. Rate of Strain

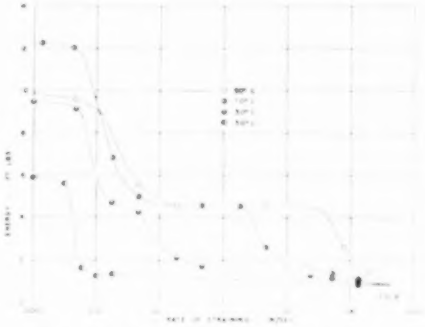

Figure 4. Impact Energy vs. Rate of Strain

DATA FOR RIGID VINYL CHLORIDE-ACETATE COPOLYMER

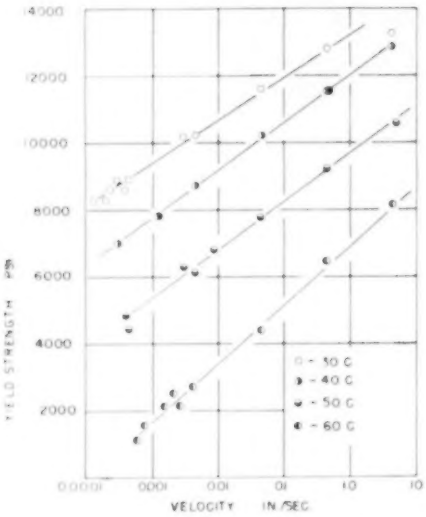

Figure 5.

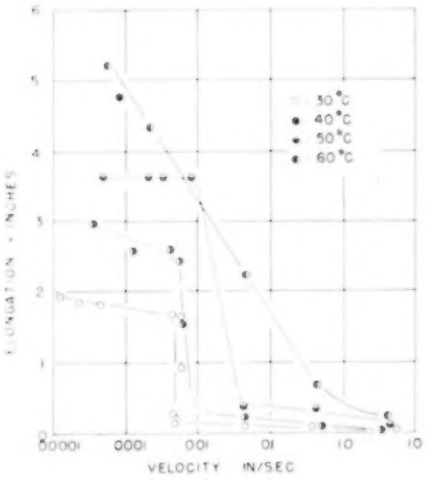

Figure 6.

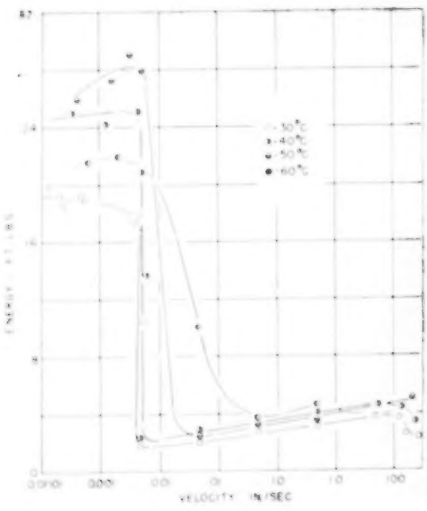

Figure 7.

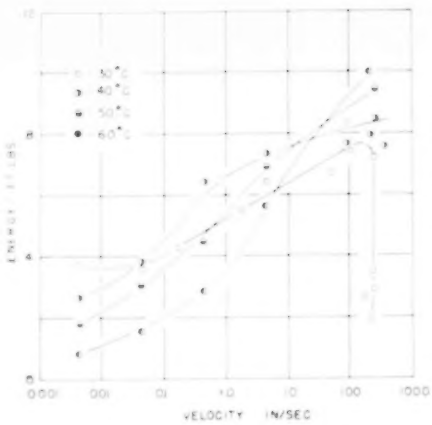

Figure 8. Data fo ethyl cellulose with 15% plasticizer.

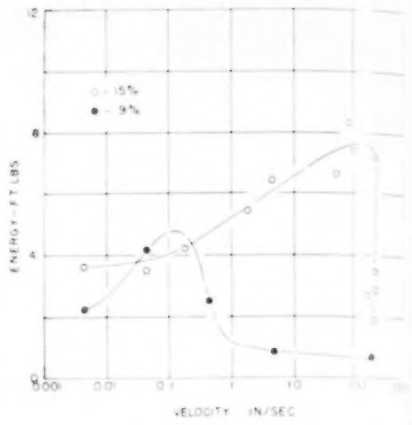

Figure 9. Data for ethyl cellulose with 9% plasticizer.

there is another plateau of low energy which represents the amount of energy the material can absorb elastically or by bending of the bond angles.

The first drop is dependent on the relaxation rate of the bonds responsible for restraining plastic flow and the second drop on the relaxation of the bonds restraining visco-elastic response or chain uncoiling. If tests could be carried out at even higher velocities there would be another drop at a rate comparable to the velocity of sound in the material. That is, the maximum rate of propagation of strain through the material would have been exceeded.

The effect of temperature on the location of the first drop is rather slight. There is only a slight general trend toward higher rates of straining with higher temperatures, which is the same as saying that this internal viscosity is only slightly temperature dependent. The second drop has a very definite temperature dependence; so much so that at 30°C it has become slower than the first drop.

Similar data for rigid vinyl chloride-acetate copolymer is shown in Figs. 5, 6 and 7. The ultimate loads follow the same trends as found in methyl methacrylate. The ultimate elongations also show the expected decrease with increased straining rate but in this case there are distinct drops in the elongation curves at a velocity comparable to the first drop in the energy curve. This is in agreement with the principle that the first drop represents the maximum velocity of plastic flow. It was not possible to extend the test far enough on the rate of straining scale to pick up the second energy drop except on the 30° C curve.

Many interesting problems can be studied with the technique, for example the effect of plasticizers. Does the addition of plasticizers shift the position of the drops or just raise or lower the energy plateaus? Fig. 8 shows the results obtained on a sample of ethyl cellulose containing 15% plasticizer. Again only at 30°C was it possible to pick up the drop. Due to the high temperature dependence of this second drop it was impossible to reach rates of straining high enough to locate the drop at higher temperatures.

For comparsion another sample of ethyl cellulose with only 9% plasticizer was tested at 30°C. The two curves are shown in Fig 9. It is immediately apparent that the addition of plasticizer shifts the location of the drop out on the rate of straining scale and also increases the energy to break prior to the drop.

Fig. 10 shows the 30°C curves for methyl methacrylate, rigid vinyl, the two ethyl celluloses together with data on a wood flour filled phenolic for comparison. Since this last material does not exhibit any plastic deformation even at very slow rates of straining it does not show any drops in the energy vs. log. rate of straining curves, just a steady slight increase corresponding to the increase in ultimate strength. Similar data also have been found for polystyrene.

The effect of rate of straining on the tensile impact strength of nylon is shown in Fig. 11. In the velocity regions where we would expect to find sharp drops in the energy curves we see that there are peaks or bumps instead. Since the energy to break depends on both the amount of force required and the amount of elongation at break these two factors must be acting in such a way as to show large amounts of energy at these rates of straining. An inspection of the load deformation curves gives us some insight into this phenomenon. In the region of the first peak the yield load is constant with rate of straining while the elongation at break increases slightly. This results in an

crease in the energy to break. At very slow rates of straining the time under load is very long and therefore there is time to fail before reaching a high elongation. As the rate of straining is increased the time under load decreases and it is therefore possible to reach higher elongations before the break. Of course as the rate of straining is still further increased the elongation at break decreases in a manner similar to that found in methyl methacrylate and rigid vinyl due to the freezing out of the relaxation. Although no data on elongation could be taken in the region of the second bump, a similar explanation seems reasonable.

CONCLUSIONS

There are many interesting conclusions which may be drawn from this study. Those which are of theoretical significance are:

1. The yield strength increase logarithmically with the rate of loading.

2. An increase in temperature causes a change in the yield strength which is similar to that caused by a decrease in the rate of straining.

3. It is usually possible to find two distinct energy drops for themoplastics in the velocity range covered in this study.

4. Energy drops would not be found in materials that do not exhibit plastic flow.

5. Plastic flow (chain-chain slipping) can not take place at velocities greater than the lower critical velocity, which is determined by the first energy drop.

6. Retarded elastic deformation (chain uncoiling) can not take place at velocities greater than the second critical velocity which is determined by the second energy drop.

7. Only elastic deformation takes place above the second critical velocity.

A more practical application of the results leads to the following conclusions.

8. Impact tests should be performed over a wide range of rates of straining to properly evaluate the properties of a material.

9. These impact tests should also be performed over the temperature range to be expected in any applications of the material.

10. The addition of plasticizer to the polymeric material shifts the location of the energy drops out on the rate of straining scale and also increases the energy the material can absorb at velocities below this drop.

In general a material must "give" with the blow if it is to have a high impact strength. This may be accomplished by: (1) having a high elastic response which would give a large energy value above the second critical velocity, (2) having either a high energy for the retarded elastic response or a very rapid retarded elastic response (which would mean a high second critical velocity), or (3) by having a rapid plastic response.

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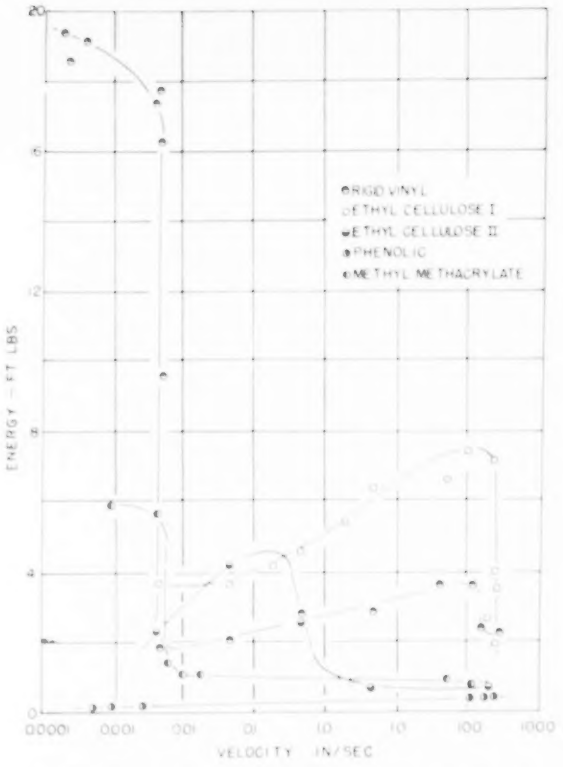

Figure 10. Impact strengths of five common plastics as a function of velocity of impact.

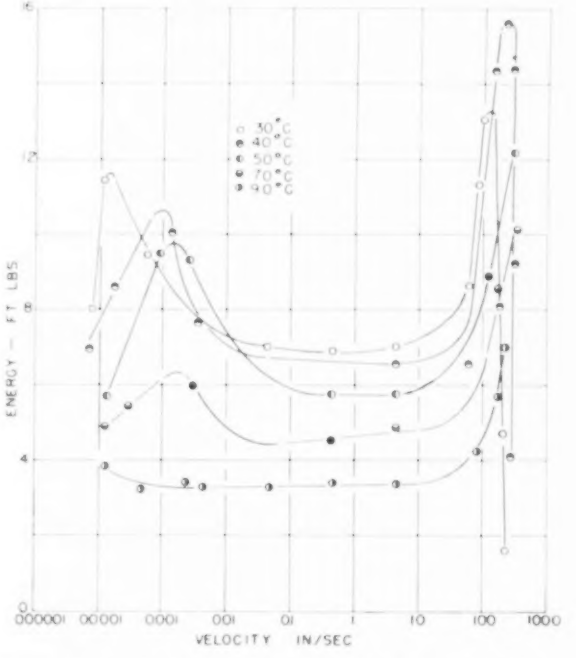

Figure 11. Impact strengths for nylon as a function of impact velocity, at several temperatures.

Successful Designing For Plastics Molding

By W. M. Halliday

The design and application of ribs may be incorporated as part of the design of a molded article.

BOTH the component designer and the mold designer will often have recourse to the extensive use of ribs to accomplish a variety of practical functions or to meet some specific requirement. For example, by the introduction of ribs at carefully selected points in the component construction, the article may be more closely adapted to fulfill its service functions. On the other hand, appearance and æsthetic value may also be improved by such means. Further, the fashioning and operation of the molding tool can be achieved more economically by the use of ribs.

Ribs will be employed to the greatest advantage in injection or compression moldings which are required to meet special considerations of strength, rigidity and resistance to bending or deflection, as in the case of moldings for industrial uses. By using ribs in the component design form, these valuable features can often be attained without adding to the weight of the article, or unduly increasing its general wall thickness.

Ribs are also very helpful in promoting the appearance of a molding, i.e., as means for interrupting the plainess of extensive perfectly flat glossy surfaces. With the latter, if unrelieved by ribs or some similar feature, general appearance may be considerably impaired due to the presence of such defects as surface flow markings, minute blistering, roughened surface spots, open weld lines, sinkings, surface cracking, and so forth.

All such surface faults will, of course, be appreciably magnified and accentuated if situated upon large flat shiny surfaces, which of themselves possess poor light-reflecting qualities and where the high lights will be spread over large areas.

As an alternative to the use of such completely unrelieved flat surfaces, the designer may provide for a slight degree of curvature, coupled with a number of carefully disposed ribs, or ribbed-up edges. By this means the light-reflecting capacity will be improved. Ribs of this kind will also often materially assist in concealing the unavoidable slight defects formed on such surfaces.

It will also very often be practicable for such ribs to be laid-out or worked into an attractive pattern, thus enabling defects to be hidden in a still more effective manner, and at the same time to increase the strength and mechanical rigidity of the component by greatly minimizing the tendencies towards after-molding warpage. Patterned ribs of this character will provide much smaller areas of high light reflection.

A variety of rib shapes and forms are of course, available to the designer, but some care will have to be exercised in their selection so that the form ultimately chosen will be one in the closest conformity with essential mold manufacturing and operating requirements.

It should be appreciated that ribs cannot be disposed more or less at random at any point upon the surface of the component, nor can peculiar and awkward shapes of rib be specified to the whim of the uninformed component designer who may be unaware of important mold-making and operating needs.

Before stipulating rib location and shapes it will be advisable to consult with the mold designer, and it will be desirable to allow this latter person a good deal of discretion and latitude in respect of the introduction of such ribs with any projected component design.

With many molded articles it will be found that the quality, appearance and general physical properties can be improved, and that reproductions of articles from the mold may be facilitated to a large extent by the adoption of judiciously disposed ribs of the kinds now to be explained and illustrated.

It has to be remembered by the component designer that one of the chief problems confronting the molding engineer, when having to produce parts of certain designs, is that of avoiding distortion, cracking and warping. All these disadvantageous features may arise during the time the component remains in the mold prior to ejection, or later when the part is removed from the mold, and is subject to the free contraction stresses. If the component has to be provided with large flat surfaces, or relatively thin section, and completely unsupported by stiffening bosses, ledges or ribs, externally or internally situated, warping troubles will be very prone to occur.

It is for these reasons that the mold designer should be afforded the maximum opportunities to introduce ribs for the successful elimination of those troubles.

Various types and shapes of ribs may be employed. They range from the very shallow raised projection, having a height of only a few thousandths of an inch above the normal external surface of the wall, to the substantially raised projection.

The shallow kind of rib will generally be employed purely to improve the appearance of the part; the other type, having considerable height above the wall of the molded part, will be used mainly as a stiffener for bracing unsupported portions of this wall, thus increasing its strength and resistance to bending or distortion.

Some Common Forms of Ribs

Sizes and shape of rib will, of course, be largely determined by the purposes to be attained, and the ability of the mold maker to reproduce the form successfully and economically in the mold cavity contours. This latter consideration should always be kept well in view when selecting rib forms and sizes, and their location on the outside or inside surfaces of the component wall.

The sectioned diagrams of portions of a component wall, shown at Fig. 1, illustrate a number of common types of ribs and their application. These diagrams also serve to indicate certain undesirable design features which are to be avoided by the molded component designer when specifying ribs. Preferred forms are illustrated, the adoption of whies will ensure much more satisfactory quality in the finished article, and give the maximum simplicity of reproduction in the mold, and during the molding process.

The form of rib shown at (A) is generally employed upon an external surface for the purpose of enhancing its appearance, or to conceal some minor surface defect which otherwise would be thrown up into prominence. The introduction of a shallow rib of this kind will often be the valuable for breaking or interrupting extensive flat plain surfaces.

As will be observed this type of rib is only of moderate height above the top surface of the wall. The sides of the rib are very acutely inclined so as to bring the crest almost to a sharp edge. It will be advisable, however, to avoid having a perfectly keen corner at the top of the rib, especially in the case of a compression molding in thermosetting materials. A slight radius at the crest in the manner depicted will often considerably simplify the reproduction of the rib channel in the tool. It will also be the means for preventing picking and snipping when the finished product is handled or when it is in service.

Razor edges and sharp corners on a molded component are always to be avoided for a variety of practical reasons, one of the chief being their liability to chip and snip easily. A ragged, broken and uneven edge at the crest of patterned ribs, for the

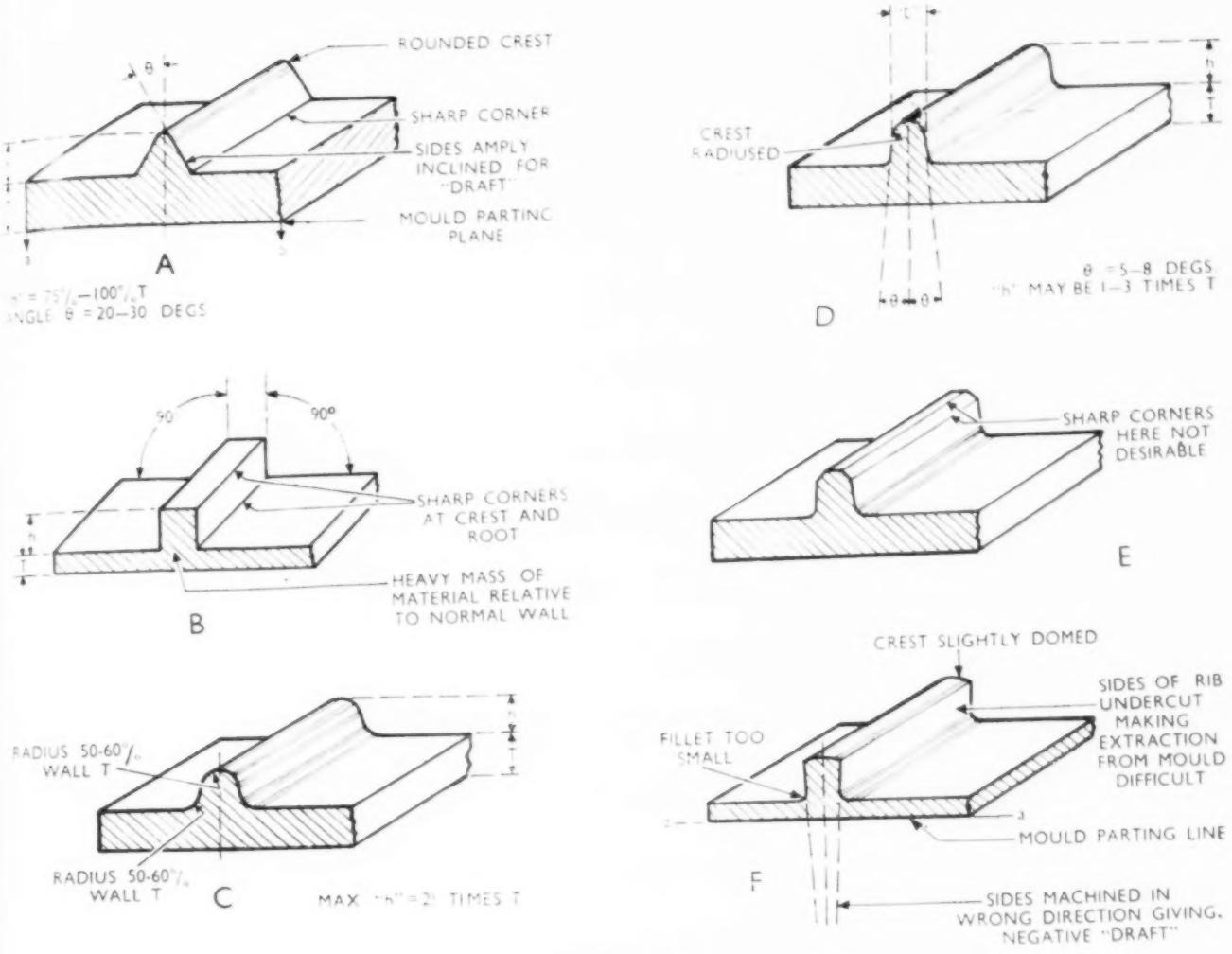

Fig. 1.—Common types of ribs for plastics mouldings.

stance, will mar the appearance of the finished article.

Very sharp corners and edges are also much more difficult to mold, because of the sudden arrestation or interruption to the direction of flow, and the greater risks of damaging those portions when the component is ejected from the mold cavity.

One further important point deserves to be noted in respect of this kind of rib design. With the example given at A, it will be observed that a perfectly sharp corner is left at the root of the inclined sides where these join to the wall proper.

Such a sharp corner may not prove deleterious in cases where the wall thickness can be of sufficient magnitude. If, however, the wall is of very slender cross-sectional thickness, the presence of such a sharp corner might give rise to several troubles during molding. For instance, the slender portions of the wall immediately surrounding the rib may be distorted due to the unequal shrinkage stresses, or the tendency towards cracking at the root of the rib may be increased again because of the uneven contraction occurring at that point.

To avoid these tendencies it will be desirable to blend the sides to the wall with a small radiused fillet. This will also appreciably increase the strength of the ribbed portion.

By employing a considerable degree of inclination on the sides of the rib formation, little difficulty will be experienced when removing the finished article from the cavity, indeed the normal shrinkage of the solidifying component will tend to ease the part out of the cavity a slight amount, thereby promoting safer and quicker ejection.

With this component-rib design the mold parting surface is denoted by the line "a—a" which is situated along the lower edge of the wall. This means that the whole of the cavity formation for the wall and the channel for the raised rib can be machined wholly within one mold block. This, of course, is the simplest form of rib disposition, simplifying as it does the machining of the rib portions of the cavity. With this form of rib location the toolmaker will not be presented with awkward or difficult matching requirements on the rib, as would be the case if the parting line surface of the mold were to pass through the rib.

This kind of rib location should always be selected wherever possible, not only because it is the most economical to produce in the molding tool, but also because it ensures a complete absence of flash along the crest of the rib, and thus will permit the buffing of the finished component to be performed with greater ease and speed and at less cost. The appearance of the finished part will likewise be maintained at a high level by the absence of a parting-line marking at the top of the rib. These may appear simple and relatively unimportant design considerations, yet it is exceedingly easy for the component designer, unfamiliar with mold-making provisions, to specify locations for ribs which will occasion these kinds of trouble and defect.

The type of rib shown at B is not to be recommended for several important practical reasons, which are worthy of note because they serve to illustrate certain features which should be strenuously avoided when evolving a component design.

In the first place, the shape of the rib is unsuitable in that the sides are disposed exactly at right angles to the face of the component wall. This

means there will be no extraction "draft" provided thereon, and as a result sticking and hanging of the article in the cavity formation can be expected.

Moreover, the rib is of an excessive height in relation to its width, and to the thickness of the wall on which it is joined. These two undesirable conditions will give rise to certain molding difficulties, whether the part is produced as a compression or as an injection molding.

The molding difficulties liable to occur are as follows: In the first place they will result in the formation of an unduly heavy mass of material in the rib in contrast to that contained in the wall itself. This disparity will result in very unequalized contraction stresses occurring at the root of the rib, which would be liable to cause distortion and excessive warpage of the wall material immediately around the base of the rib.

Secondly, the rib itself by reason of its excessive height will be very weak, and its ability to serve as a stiffener or bracer for the unsupported walls of the part will be diminished.

Thirdly, the sides join to the wall in a perfectly sharp corner, and the absence of a fillet at this point will mean the rib will be relatively weak. If the molding should happen to be very long in length, or extensive in surface area, features which entail appreciable lateral shrinkage on the part, the rib might easily be cracked at the root, or even bent before the component can be removed from the mold cavity.

Fourthly, it should be noticed that the crest of the rib is formed perfectly flat with sharp corners at each side. This, again, would occasion certain difficulties when machining the mold cavity. It is well known by toolmakers that greater difficulties at the root of a cavity channel, than is the case if such portions may be formed with a slight radius. Cutter wear on a pointed tool is much more rapid than with one having suitable radii. Usually, to reproduce the former sharp-cornered kind of channel will require a greater amount of hand trimming and tooling than is the case with radiused channels.

The reproduction of rib channels having perfectly square sides of the character depicted will also entail additional care on the part of the toolmaker when machining, so as to ensure that no undercut portion is formed at the root of the rib or that the surfaces of the channel sides do not become torn and roughened by the passage of the cutter.

It would, of course, materially improve this form of rib if its crest were to be domed or even radiused off completely to a half circle. This would not only simplify the cavity machining requirements, but would also result in the sides of the rib being reduced considerably in height, thus ensuring that the extraction of the part from the cavity would be accomplished with greater ease.

Because of the foregoing drawbacks this form of rib should not be employed. It would only prove practicable where the height of projection of the rib could be maintained at not more than about one half of its width.

The kind of rib design illustrated at C is in very widespread use and possesses the merit of pleasing appearance when disposed on an external surface of a component for strengthening the wall structure of an article.

This form of the rib comprises three radiused portions, blended very smoothly with each. The radius of the rounded crest is approximately equal to that of each side portion joining on to the wall of the part. The radii of the fillets each side of the rib may form 50-60 per cent. of the normal wall thickness ("T") of the component.

The height of projection of the rib ("h") may be varied within fairly wide limits, and as a maximum should be about two and a half times the thickness wall, "T." The greater the height "h," the larger should be the radii of the three curves composing the rib. The radii should in fact be made about 40-50 per cent. of height "h," with the two side curves forming the fillets for joining the rib to the wall being made slightly smaller than the crest radius.

It will be understood that with this form of rib there is actually no plain straight portion in the sides, since the respective curves at these two points are quarter-circle in magnitude. They blend closely to the half-circle of the crest portion. This will mean in practice that the minimum amount of drag will be offered to the extraction of the component, because the curved formation of the rib will possess ample draft.

Care will be required when blending the curves to each other to avoid leaving a slight depression, or groove, as this would constitute a shallow undercut which would offer increased resistance to ejection.

Very little difficulty will be encountered during the molding and removal of the component with such a rib which is correctly formed according to this design. It is extremely strong and serves excellently for increasing the rigidity of a component having thin wall section and liable to excessive distortion or warping.

There is, however, one particular draw-back worthy of note. Some objections may be experienced by the toolmaker when machining the female form of cavity channel for this shape of rib.

Its reproduction in the mold will entail the use of a specially formed end-milling cutter, carefully pre formed to the reentrant curved formation. Failing the use of such a specially shaped cutter, an ordinary end-ended milling tool may be used. The straight sides and sharp corner thus left by such a cutter on the rib channel would have to be removed by hand filling and tooling means to the requisite fillet curvature.

Such a manual operation would, of course, be very protracted, tedious and exacting, resulting in a great increase in the time required to manufacture the mold, and a commensurate addition to the costs and charges to be passed to the client.

The design shown at D is perhaps the most widely acceptable form of rib favored by mold designers. With this design the sides of rib are straight, each one being inclined anything from 5-8 degrees from the vertical as shown, thereby ensuring that the width at the crest will be appreciably less than the width at the root, to give the necessary draft for ejecting the part out of the cavity.

The crest of the rib is made semi-circular in cross-sectional shape, and it blends out smoothly with the straight sides. A small radius or fillet is provided at the root of each side portion, this being blended evenly with the top surface of the wall.

Good working proportions of the sizes of this type of rib, relative to the wall thickness, are as follows: The height of projection "h" may safely be made as much as two or three times the dimension "T," although it is customary to restrict this to about one to one-and-a-half times "T." Where the height is to be made three times the thickness of the wall it will be advisable to make the straight sides with an inclination of 8 degrees, and also to increase the radius of the side fillets at the root. The maximum thickness "t" of the rib, measured across the root portion as depicted, should be maintained from about 75-80 per cent. of the height "h." The radii of the side fillets joining the rib to the wall should preferably be from one-quarter to one-third the thickness "t." These proportions will, of course, determine the radius of the crest portion.

When correctly proportioned this is an excellent type of rib, the reproduction of which will entail little difficulty for the mold maker. It ensures a very uniform thickness of material through the wall formation, and, moreover, enables the molding to be readily extracted from the cavity during ejection. It is also of considerable strength, rendering the form particularly applicable as a stiffner or bracer for joining together large unsupported slender wall portions. This type of rib is very often employed for bridging heavier bossed-up sections of the component, either by diagonal or single line disposition.

(Please turn to Page 30)

THE *Injection* MOLDERSCOPE

By A. R. Morse

President, Injection Molder's Supply Co.

Check List

When that weighty tome "Modern Plastics Encyclopedia and Engineers Handbook" (published by Plastics Catalogue Corp., 575 Madison Ave. New York 22, New York) appears, most of us are wont to put it on the shelf and assume that it is all merely old stuff. But the handsome 1952 Edition deserves special notice from the injection molder because of Sandy Glick's excellent article on **Injection Molding** beginning on page 69. (The annual this year can have only one serious charge brought against it—the same one Chic Sale once brought against the Sears Roebuck Catalog—there are too many stiff pages in it. These awkward cardboards make it difficult to find the editorial matter especially since they are often unnumbered.)

The injection molder who takes for granted the correlation of all the various process factors like pressure, cycle, temperature etc. will do well to review Sandy's outline of molding difficulties. He has very skillfully classified and grouped the causes of various molding defects for easy reference. The article really should be reprinted and circulated among injection molders, as it is a vitally important contribution to the literature. All too often we tend to take for granted the technical articles in the "Modern Plastics Encyclopedia." This time, however, the article on **Injection Molding** deserves real laurels, and even the busiest molder cannot afford to overlook it.

One of the major troubles with articles in this book appears from a review of the last 10 Editions' articles on Injection Molding Machines. There has often been an editorial over-emphasis on things that from a practical point of view were comparatively unimportant in the injection industry. For example, considerable space was once devoted to an injection machine which was a complete failure, and almost no mention was made of a machine of which nearly 1500 were sold in a single year! Thus anyone looking for practical information on equipment would be so completely misled, for it appears that a machine which is now virtually forgotten was more important than the machine which was the backbone of the industry!

All trade publications face this same difficult editorial matter: how to give new ideas a hearing, how to keep the news in front of their readers, and yet not neglect the fact that it is the drab established, old proven product that is the real money maker of the industry. Nor can trade publications neglect a good advertiser, no matter how dubious or still unproven his product.

But back to the Check List. Hats off the the 1952 Modern Plastics Encyclopedia for its article on Injection Molding, and to Sandy Glick of Monsanto for giving us a practical article that is really worth looking up and reading. It's only a shame that Sandy did not get to treat the special section on Styrene Co-Polymers on page 74 with the same fresh analysis he used on injection molding, because in the new co-polymers of styrene with itself and goodness knows what else, is the key to most of the future successes in injection molding!

Mold Releases

One of the most common troubles with substances used for injection mold releases is that they cause more rejects from marked parts than they save by releasing stuck parts from the mold cavity. The number of substances that can be used for mold releases is amazing, ranging from mineral oil to polyvinyl alcohol with which latter we are experimenting now—but they all have one big fault—if applied too heavily they tend to mark or cloud the molded part. The mark of a good mold release therefore could well be how little release it contained rather than how much! There are some mold releases now being offered which are diluted with various substances, often to the product's extreme disadvantage as far as injection molding goes. When the smoke blows away, pure silicone is probably one of the best injection mold releases, seconded only by zinc stearate, or zinc stearate mixed with 25% calcium stearate to prevent "balling." But silicone is quite expensive, so it is natural to try and find an extender for it. In general, extenders for silicone are either very flamable, or very toxic (chlorinated hydrocarbons) and the best way to extend silicone is to stay away from diluted solutions, and instead use it sparingly and with good judgement.

Overuse of stearate is a common cause of undue mold wear and damage to both the mold and injection machine, as the powder is NOT a lubricant for metal surfaces like pins and cores, but an abrasive! This characteristic of stearate is often overlooked. I have actually seen platens that needed to be rebushed because excessive stearate used as mold release had caused triple wear on the bars! And don't forget that zinc stearate is a metallic salt which is harmful if inhaled over long periods!

But back to mold releases as such. It must be borne in mind in selecting a lubricant for injection molds that many materials which are quite successfully used on rubber or compression molds may not be at all suitable for injection work for a variety of reasons, but chief among them is lubricant marks. Selection and use of mold lubricants is all too often a matter of operator habit rather than necessity. The BEST injection mold is one that does not need any release at all. Operators should be trained to regard an injection mold release as a short cut to getting a good "dieslick" so the mold will operate without any lubrication. An injection mold release is like a crutch. It is better to fix the mold than to use a mold release as a production tool unless conditions are exceptional. The cycle time alone needed to dust or spray the mold is enough of an argument to sway the case in favor of fixing the mold, except that we seldom take time to figure that 2 or 3 seconds extra each cycle soon adds up to more than the day out to fix the mold. On short runs, however, it is sometimes better to use the release regularly, and of course there are certain molds that won't run without a release. There is one benefit of the silicone type lubricant often overlooked, it is a good lubricant for pins, cores and other moving mold parts. Silicone grease is also available to use on stored molds. It's clean and does not bleed out like ordinary greases after the mold is put into use again. This incidentally is not the same type of silicone grease that can be used as a spot lubricant on an operating mold, but one specially compounded for protection of valuable molds.

WEIGH FEEDING

Dow Chemical Co., Midland, Michigan (Plastics Technical Service Department) have release a multigraphed article outlining the advantages of weighed feeding for injection

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Fully Automatic Molding

Quentin M. White

Director of Molding Press Sales
F. J. Stokes Machine Co.

The main difference between semi and fully automatic operation is the amount of labor required. This one fact largely determines the economic slot into which fully automatic molding fits. It is recognized that there are many jobs where the production requirements dictate a given number of cavities for the job. However, to run this number of cavities in a semi-automatic press would make the labor cost per piece prohibitive.

Therefore, the molder is required to build a larger mold, at a higher initial investment, in order to reduce this labor cost per piece. It is necessary to strike a balance between mold cost and labor cost. In this balance between mold cost and labor cost, fully automatic molding finds its place as the most economic process whereby the part under consideration can be produced in the quantities required. Due to the low labor cost per machine, the number of cavities selected can be guided more by the production requirements and the labor cost factor does not have a large influence.

In keeping with this line of thinking, the first automatic presses were of 10 tons capacity and were built to accommodate small molds of low price. Also, there was no great emphasis based on speed since the curing time was by far the greatest portion of the molding cycle. Later, it became apparent that there was a need for a larger press for larger parts and more production of small parts and a 50-ton press was introduced. This need for larger presses could not be met by speeding up the original small presses because of the extended cure time. Both the 15-ton and the 50-ton automatic presses had its own field of application which was governed by the size of the part and the production requirements.

However, a new factor has come into the picture within the last few years. This factor is the advent of faster curing compounds, not only of the alkyd group, but faster phenolics and ureas. This advancement did three things. First, it broadened the field of automatic molding and made production of thick section parts formerly molded by transfer or preheated compression molding presses economical. Automatic machines could now be economically applied to thick section parts whose size and production requirements had, before the advent of faster curing compounds, made them more economical to run in transfer presses. Second, it allowed molders to get more production per cavity and thereby allowed them to consider a smaller automatic press for any given production requirement on pieces of relatively thin walls. Third, by speeding up the cure time, the press time became a more important factor in the overall cycle. A combination of the last two items, namely more production per cavity and the fact that a smaller press could handle a given production requirement, and the need for higher speeds, created the need for a small, fast, fully automatic press. This item was the basic economic need which started the development of the model #800 press.

In reviewing this, we find that definite features were required in this new press. First, it had to be a fully automatic unit and second, it had to be fast in order to close before precuring of the material started and in order to limit the press time to the smallest portion possible of the overall cycle. The fact that it had to be fully automatic meant that a positive ejection system and the necessary safety devices to stop the press in case any action was interrupted, had to be incorporated in the design.

The requirement of speed was easily met by utilizing a toggle type construction coupled with an air cylinder for pressure. The natural toggle action of fast motion during the initial part of the stroke with an automatic slow down as the die closed was ideal. Fast closing speeds were obtained without incurring excessive pressing speeds which would force the material to flow before it had plasticized and would have caused undue strains and wear on the mold. Also, this toggle gave the necessary mechanical advantage to allow the use of an air cylinder for pressure. Naturally, the accumulator effect of an air compressor permitted the delivery of a large supply of air over a short period of time without requiring exceptionally high power requirements. Furthermore, the compressibility of air made possible effective cushions at the end of the stroke.

Mechanical actions, which were provided by cams positioned on a common shaft, allowed for fast feeding and ejection motions which were perfectly timed and synchronized. Furthermore, there was no dead time due to valve shifting such as would have been necessary had a hydraulic system been used. The machine was sequence operated in that the completion of one motion started another motion without any loss of time. The overall results of this designing for speed was a 15-ton fully automatic machine with a press time of seconds.

In using this machine to produce parts formerly produced on other of our fully automatic presses, it was found that up to 40% more pieces per cavity were obtained on thin walled urea pieces. The production of one particular small alkyd piece was 60 pieces per minute from a 12-cavity mold.

How far this trend towards faster smaller presses will go, we can only guess. However, it is not at all inconceivable that automatic preheating could be coupled with a fully automatic press. This, of course, would make faster cycles possible without restriction to the physical properties now available in the fast curing compounds. Of course, the ultimate goal of all this work is to broaden the field of application for plastic parts by reducing their costs and making them the best parts available for the job at the lowest possible price.

Successful Molding

(Continued from Page 28)

Another design E shows a slightly modified form of the preceding shape of rib, which is sometimes used. The shape is substantially the same as that of example D, with the exception that the crest is not rounded but is composed of three narrow flat portions, in the fashion depicted.

The necessary channel cavities for this kind of rib will be similarly capable of easy reproduction, by means of a simple tool.

If this rib form is maintained reasonably low in height above the surface of the wall its appearance value will be enhanced, since there will be five flat surfaces disposed at varying angles to each other thus giving good light reflecting features.

When machining the channel cavities for such a type of rib, it will be advisable to leave a very tiny radius at the corner of each flat portion comprising the crest, so that razor edges will be eliminated on the rib of the component.

The last example, shown at F, indicates several very undesirable features of rib design which must be carefully guarded against when developing a component design form. With this kind of rib it will be specially noted that the height is very considerable in comparison with the wall thickness of the component. In practice this will mean that the stiffening properties of the rib will be seriously diminished.

Further, the sides of the rib are straight and inclined in the wrong direction to allow the finished molding to be easily extracted from the cavity. The width at the crest is

(Please turn to Page 34)

PLASTICS AROUND THE WORLD

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AUSTRALIA

AUSTRALIAN PLASTICS

Vol. 8, No. 85, August 1952

Abstracter: Albert Lightbody

PLASTIC AIDES IN AMAZING MECHANICAL HEART-LUNG MACHINE

A combination of a mechanical heart and an artificial lung has been used by the Hahnemann Hospital in Philadelphia, Pennsylvania. In operation, the dark bluish-purple venous blood is detoured from the patient's two largest veins through the oxygenator or artificial lung where the carbon dioxide is removed from the blood and replaced by oxygen. The mechanical heart, a Vanton squeeze action pump, returns the blood to the carotid artery. The rigid parts of the mechanism are constructed from polymethylmethacrylate while the flexible material in the pump is made of pure surgical gum rubber.

SHEET VINYL ELECTROTYPE PROCESSING

Vinyl sheets are formed to give impressions of page forms, electroplated and then stripped. The electroformed plates made in this manner can then be used in conventional manner for printing. The method was developed at Batelle Institute and is now used by such companies as the U. S. Government Printing Office and the Meredith Publishing Company. The latter companies have been using this process for nearly ten years very successfully.

PLASTICS MACHINERY

British Industries Fair exhibition at Castle Bromwich, Birmingham, May 1952, displayed the heavy machinery manufactured and supplied by British Industry. Included in the description of industrial plastics equipment was spraying equipment for spraying of plastics and also for metals. Presses and extruders of various types, described in the article, were displayed. Other displays and descriptions included molds and steels, control and measuring equipment as well as grinding equipment.

MOLDING OF HEAVY SECTIONS, GORDON THAYER

The difficulties encountered in molding heavy sections (greater than 1/8 inch) of plastics are listed with the reasons for possible failures. Instructions for avoiding these difficulties are suggested with many effective methods.

VINYL SPONGE FINDING APPLICATIONS IN MILITARY AND INDUSTRIAL FIELDS

The vinyl sponge invented by the Germans has been developed by American engineers for use in many items. This material, which withstands the effects of weathering, oils, greases, solvents, abrasion and high and low temperatures, has been used for net floats, life rafts, X-ray head cushions and many other uses.

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GERMANY

KUNSTSTOFFE

Abstracter: Anne Schwend

Abstract from the September 1952 issue of "Kunstsoffe" Magazine.

E. C. Blackard—"Extrusion of Acetate Sheet and Large Pipe."

A reprint of the article contained in the March issue of the SPE Journal.

David J. Sloane — "A Proposal for Establishing Certified Injection Molding Machine Specifications."

A reprint in condensed form of this First Prize in the 1951 SPE Prize Paper Contest.

D. McPherson in "Metallurgia" — "Metallizing of Plastics under High Vacuum."

An abstract from a survey on the metallizing of plastics under high vacuum and the "Shiny Spray" process. Since neither these two processes nor silver- and electroplating do satisfy entirely, the author attributes the most prospects to a British process which calls for "alloying" reduced silver with the plastic material. Details of this process, however, are being kept a secret so far.

Dr. Gearhard Beck, Wuppertal-Elberfeld — "Water Absorption and Loss of Plasticizers by Non-Rigid PVC Under Current Water."

While rigid PVC absorbs at the maximum up to 1% water, the absorption of water by non-rigid PVC foils may differ considerably. Since the cable industry in particular was interested in the water resistance of the non-rigid plastic materials used, several tests were conducted with soft foils gelatinized without pressure. The foils were put into running water of 18 to 19°C. Three different groups of PVC materials containing emulsifiers may be distinguished as regards loss of plasticizer (on a percentage basis to the entire film weight):

a. less than 1% loss of plasticizer, among which are dicoctylphthalate, Mesamoll, Edenol 242, Edenol 242 K, Trikresyphosphate, Platinol HSN.
b. from 1 to 4% loss of plasticizer embracing Plastomoll WH, plasticizer BOA, plasticizer A 77, Palatinol C, plasticizer IW 400.
c. high loss of plasticizer for materials containing IW 40.

When testing foils of the same thickness, but gelatinized under pressure and calandered, under the same conditions the results obtained do show losses of plasticizer about one third less than foils gelatinized without pressure. Reduction of the plasticizer content to less than 30% of the film weight will reduce the tendency to absorb water considerably.

The influence of fillers was investigated, too, and resulted in considerably higher absorption of water. The use of extenders influenced the soft PVC materials partly positively, partly negatively, depending on the kind of extenders used. Incomplete gelatination of the materials to be tested permits much quicker loss of plasticizer and absorption of water. Non-rigid PVC foils tested prior and after treatment in water for tear resistance will show increased strength in the same amount as they have released plasticizer. The impact strength, too, increased parallel to the loss of plasticizer. Non-gelatinizing extenders may nullify this effect. Antifreezing properties were reduced in the same amount as plasticizers were extracted.

The statements made above do apply only for tests conducted under temperatures of between 15 and 20°C and may differ very much when temperatures are increased or reduced.

German Standards Committee — "Proposal No. DIN 53480 for the

Determination of resistance of insulating materials against creeping current."

It is suggested that all manufacturers of insulating materials adopt this proposal for testing and report the results to the competent sub-group in the German Standards Committee. The proposal is meant to judge the reaction of voltage conducting parts in case of exposure to moisture, foreign matter and other influences. Proposal gives definition for creeping current, traces of creeping current and resistance thereto. Three different testing methods are provided:

a. "Nekal Drop Procedure" — dropping (drop by drop) an electrically conducting solution (Nekal solution) between two electrodes for 380 AC onto the insulating material to be tested. A variation of this method is already known in the United States and was published by K. Wyatt in Elec. Power Engineers Assoc. Paper, November 1938, "Trend of Power Cable Research in America."

b. "Nekal Dip Procedure" — dipping the horizontally lying test material on which have been put two electrodes, in vertical direction into an electrically conducting solution (Nekal solution), taking it out, letting the solution trickle down and dipping the material again. It has to be stated how often the material and the electrodes have to be dipped into the solution in order to create a short circuit. This procedure will permit the testing as to usability of plastic parts with pressed or screwed in metal parts, the latter acting as electrodes in this test.

c. "Vapour Test"—Material to be tested is put onto two electrodes which are kept under alternating tension of 10 kV, and exposed to a predetermined amount of vapour. It has to be stated after how many seconds of such treatment a short circuit will be produced.

Shape and measurements of molding compounds to be tested, pretreatment of test material, kinds of electrodes, source of energy supply, solution and other auxiliary means used in the test are defined and kind of information the test report should contain is laid down.

Dipl. Ing. Erich Berg, Wipperfuerth, member of the physical laboratory of Messrs. Bisterfeld & Stolting, Plant II, at Egerpohl — "Practical Testing Method of Resistance against Creepage Flash-Over."

This article is printed upon the express desire of the German Standards Committee and put for discussion by all those interested in the subject.

Claims from customers induced Messrs. Bisterfeld and Stolting to look for other testing methods for materials that, according to the "Nekal Tests" (as above) has proved resistant against creepage flash-over. The sole decisive factor is the amount of voltage an insulating material will withstand in case it is exposed to creeping current, and that the number of drops of "Nekal" solution at low voltage a material can withstand without being affected are only of secondary importance.

With the help of the abovementioned diagram the new method is described at length, the test results obtained by the "dry" process and under vapour influence compared with those obtained by the "Nekal Methods" and the theories on which the new method bases are enumerated.

Dr. Ing. W. Woebken, member of the plastics laboratory of Messrs. Kloeckner-Moeller G.m.b.H. at Bonn—"Drop Test of Resistance of Insulating Materials Against Creepage Flash-Over."

Messrs. Kloeckner-Moeller have developed the automatic "drop-giver" to the above proposal of the German Standards Committee. Author lists reasons for application of the "Nekal Method" under reference to similar testing methods in other countries. Reports about experience in the testing of phenolic resins and melamines. Classification of certain urea resins is difficult since they do not burn but show a strong tendency for gasification. Doubts whether it would be practical to expose the test materials to severer conditions which would deviate from normal practice. Though feasible, these would fall into the category of arc loads for which analogous testing methods as those developed for creeping flash-over resistance would have to be developed.

Dipl. Ing. Hans Gastrow, Berlin-Lichterfelde—"Balance of Energy for Thermoplastic Injection Molding Machines."

One of the decisive factors for judging an injection molding machine is energy consumption which is essentially composed of power consumption for operating the machine and on the other hand for plastification of the material. A comparison of the different operating systems (hydraulic drive with one high-pressure step, hydraulic drive with low and high pressure steps, hydraulic drive with pump of varying output and without energy storage, direct electric drive for mold closing and plunger advancing movements) is made based on the same injection capacity for all machines. Juxtaposition of the calculated energy consumption and the theoretically required power consumption leads to the conclusion that the rate of efficiency is in some cases very low.

Reference is made to German patent applications Nos. B 16452 XII 39a and G 7446 XII 39a which may permit a combining of the advantages of energy storage drive with those of direct electric drive. These patent applications describe a high speed injection molding machine with one to one and a half ounces capacity, with small electric motor which charges a fly-wheel with energy. From this fly-wheel power is taken off by means of electric couplings into one or the other direction and transferred to a toggle-lever drive operating the mold closing and plunger advancement in the same direction. Thus, a special plunger drive become superfluous.

The mold is locked at the four corners of the mold platen by a 50 tons pressure. Further movement in the same direction of the closing frame will push the heating cylinder, shortly prior to the yield point of the toggle-lever drive, over the closed mold on the stationary plunger which is supported by back-pressure springs and thus the mold is filled. Reverse movement of the toggle levers will first remove the heating cylinder from the plunger until the feed opening is freed and then the mold is opened.

The elimination of the plunger drive and its special operation simplifies the design and the electric drive of this machine, especially since there is required a switching capacity of only 25 W for the electric couplings. A further advantage lies in the fact that there is practically no energy loss from the fly-wheel, though short-timed peak power loads as required for high-speed injection processes may be withdrawn. Such a machine should allow an increase in the rate of efficiency up to 80 to 90%.

Messrs. Dippel and Goeteze, Hannover-Linden — "Temperature Gauge for Rotating Rolls."

The above company has developed a temperature gauge which is no longer dependent on the immediate touch of the roll and the measuring point. The roll emits the heat to a bi-metal spring. The small loss of heat thereby caused is compensated by corresponding plus-calibration of the spring. The gauge is provided with runners which guarantee that the distance to the roll remains unchanged. The runners may be substituted by ball bearings. The gauge may be changed to a control instrument by adding contacts.

Prof. Dr. H. A. Stuart, Hannover—"Molecular Order in High Polymers and its importance for technological properties."

A satisfying systemacy of the physical properties of high polymers may neither be derived from their chemical constitution nor from inter-

molecular powers. However, a workable hypothesis may be found if one starts from the basic properties of threadlike molecules and the powers resulting from chemical constitution as well as their geometry, and observes the alternating effect of the molecules in competition with heat movement. The article deals with the various steps of molecular order and the structural elements in the amorphous and crystalline ranges as well as the molecular texture. With the help of some examples the relationship between molecular order and the mechanical behaviour, especially with regard to fibres and plasticized thermoplastics, is explained. Thorough knowledge of the statistical form and movability of threadlike molecules as well as of the order in high polymers may be very valuable in the development of new plastic materials. Systematical tests in this direction would help to promote the quality and ways of application of plastic materials.

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GREAT BRITAIN

BRITISH PLASTICS
September, 1952

Abstracter: **Herbert R. Simonds**

THE DEVELOPMENT OF MOLDED REFLECTORS

A. A. Tomkins, Joseph Lucas, Ltd.

(5 pages illustrated)

Plastics reflectors for automobiles and bicycles are considered a necessity but their development has been a rather slow and difficult process. This article gives the history of the development of the polystyrene reflectors. The important feature in this development was the careful working out of the critical angles in such a way that reflection from one face impinged upon an adjacent face, which in turn, reflected the beam back parallel to the impinged beam. Much ingenuity was displayed not only in the design but in the molding. Finally, a hobbing technic made production of 270 facets within a 1½" diameter reflector an economical possibility. One type of present die or mold construction involves a series of hexagonal pencil-like units all bound together within a metal frame. The polystyrene reflectors are produced from such a mold on an injection molding machine.

Many adjustments have had to be made to account for slight variations in the actual reflector in comparison with the plans worked out by optical designs. For instance, imperceptible "sinks" made the facets into slightly curved mirrors thus losing some of the reflected light. The author recommends attention to the following details:—

1) Uniform heating of the material in the cylinder of the injection machines
2) Proper temperature control
3) Proper adjustment of cycle times

The mold reflex reflector has been the result of relatively minor changes made throughout the years. As typical of the production problems the author gives the following:—

"The 1½-inch cycle reflectors in polystyrene are usually produced in four-impression tools on 4-oz. capacity injection machines, much below the machine's capacity but convenient because a number of types have to be made as required, and since it is found useful for the machine operator to clip moldings from feeds and runners (which are normally returned to the cylinder) the cycle time is controlled by this, and four impressions make a "self-run" set-up. On occasions a twelve-impression tool has been run successfully on the same 4-oz. capacity machine. The larger, 3-inch diameter reflexes in polymethyl methacrylate for the automobile field are produced in a two-impression tool on a 4-oz. capacity injection machine; the shot weighs nearly 3 oz. and it is unlikely that more impressions could be accommodated."

DRY COLORING OF POLYSTYRENE

(2 pages illustrated)

"Dry coloring is a simple process in which the coloring material is added to the polymer crystal, mixed, and then fed as required to the injection machine. The process is made more effective, using the simplest of apparatus, by the introduction by Monsanto of 'colourant blend' (Lustrex L2020 PIX-6), a polymer specifically manufactured for this purpose. Colorant blend is a crystal-clear polystyrene of fine particle size given a surface treatment to aid in coloring, particularly in improving dispersion of the color and adhesion of it to the crystal surface. Molding characteristics have been improved, especially with regard to flow, mold release and freedom from surface defects, and it is claimed that the material can be molded at temperatures some 25° C below usual."

Chrome-manganese steel, stainless steel or chromium-plated drums are best though mild steel can be used if kept clean and free from rust. Using a 55-gallon end-over-end drum tumbler the mixing procedure is as follows:—

1) Charge the drum with molding material
2) Add carefully weighed coloring
3) Tumble at 30-45 r.p.m. for 5-20 minutes.

In feeding the material to the injection machine better dispersion is secured by using baffles. These are designed to increase turbulence and mixing action. The simplest device is a steel disc drilled with holes from 0.04" to 0.06" in diameter heavily countersunk in the ram side.

POLYSTYRENE BARRIER JOINTS FOR CABLES

(1 page illustrated)

Electrical cables on steep grades as in mountainous districts often give trouble due to the longitudinal movement of the insulating compound within the lead sheath. A new type of joint is described which is said to prevent movement of this sort with its resultant breakdown. The basic material in this type of joint is monomeric styrene and polymerization is delayed by the addition of inhibitors.

PLASTICS APPLICATIONS

(4 pages illustrated)

Typical applications include:—

1) Chemical Scoops
2) Oxygen tent
3) Floor polisher, component parts
4) Weighing equipment for television bulbs and extruded p.v.c. plumbing piping.

EPOXIDE RESINS FOR WIND-TUNNEL MODELS

(4 pages illustrated)

One example described consists of nine layers of light alloy sheet bonded together with hot-setting epoxide resin. The complete core is then primed with more hot-setting resin to insure a stronger bond.

A cold-setting surface layer is then added to complete the assembly. Epoxide resins filled with suitable materials can be used successfully for repairing metal surfaces. Typical fillers for this work are ground slate, mica and french chalk. Ground slate gives a particularly hard surface.

THE STABILIZATION OF VINYL RESINS

H. Verity Smith, Pure Chemicals Ltd., Liverpool

(3½ pages)

The problem of chemical stabilizers has bothered fabricators since the introduction of the vinyl family of plastics. Means of stabilizing have varied, but the author has found a mixture of three or four plasticizers and a selection from a virtually endless list of pigments to form a particular resin as the best solution.

The first problem the author found was the emission of hydrochloric acid under the influence of heat. The absorption of the acid by a strong base such as sodium hydroxide is ruled out by the tendency to dehydrochlorinate the molecule. Perhaps the most commonly used absorbent is basic lead carbonate. This is used in the form of a dispersion in a plasticizer.

The largest and most commonly used group of stabilizers was the metallic soaps. The stearates of lithium, calcium, strontium, barium, magnesium, zinc, cadmium, aluminum, tin, lead and bismuth have all been

used. The most popular are calcium, barium, cadmium and lead.

In order to inhibit the precipitation of metal chlorides the use of alkyl and aryl phosphites has been introduced. A material of this type is marketed in U.S.A. as Argus Mark XX Stabilizer.

Perhaps the most remarkable of all the many patents on the stabilization of p.v.c. is that granted to H. A. Cheney, in which he claims the use of iron salts, such as ferrous sulphate and ferric chloride. The concentration must be between one and ninety-five parts per million of polymer and quantities in excess of this cause the more familiar destabilizing action which is commonly regarded as the normal effect of iron. Other metals are shown not to have the stabilizing action.

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MEXICAN RUBBER AND PLASTICS

Vol. XII, No. 80, September 1952

Abstracter: John B. Ballard

ESSAY ON THE TEACHING OF PLASTICS TECHNOLOGY
Dr. G. M. Guzman

Proposed courses of study for technicians, engineers, and researchers in plastics. Reprinted from the Plastics Review of Madrid, Spain.

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SWEDISH PLASTICS ASSOCIATION TECHNICAL BULLETIN

Vol. 7, No. 30, August 1952

Abstracter: Walter E. Werber

PLASTIC DISPERSIONS: THEIR MANUFACTURE, PROPERTIES AND APPLICATIONS
Dr. Gustav Hagen, Badische Analine and Soda Fabrik, Ludwigshafen, Germany

Reference is made in this article to the manufacturing methods of plastic dispersion, the method of emulsion polymerization and the subsequent dispersion of plastics in water. The process of emulsion-polymerization is of great importance for the manufacture of plastic dispersions and enables the manufacture of dispersions with predetermined properties. The author deals at length with properties of the dispersions, particularly with those which are important for the subsequent techniques of applications. The article contains further a thorough discussion of the different application possibilities of plastic dispersions with particlar regard to the field of impregnation coatings and adhesives for the packaging industry.

Vol. 7, No. 34, September 1952

PHENOL RESIN ADHESIVES FOR THE PLYWOOD INDUSTRY WITH CURE TEMPERATURES OF 100° TO 120°C.
H. A. Collinson, Technical Director, Lester, Lowell & Co., Ltd., England

This paper discusses a development of the British plastics industry with regard to a new phenol formaldehyde resin supplementing the range of synthetic resin glues available for the manufacture of plywood. The relative durability of urea resin and phenol resin glues is discussed and details are given of the practical results obtained with this material under manufacturing conditions. The new resin curing at 115°C. shows many advantages over the higher temperature setting resins. It includes the absence of permanent compression of the plywood, freedom from blisters, and increased flexibility in the finished plywood, while retaining all the durability and weatherproof properties characteristic of phenolic resins.

EDITORIAL

The British official census report called "Plastic Goods and Fancy Articles" has recently appeared. The editorial calls attention to many shortcomings. To begin with it states that "the title itself will not please the plastics industry." The statistics are incomplete in that they do not cover industrial materials nor electrical wires and cables. Also, the picture given by the report accounts for less than 20% of the total plastics consumed during the period covered.

PLASTICS DISTRIBUTION
(3½ pages with tables)

This is a condensation of the British 1948 census of production reports and contains such figures as 665,000 pounds of plastics used annually for telephone instruments and components. The following table gives a few items to indicate the nature of plastics sales as listed in the full report.

Product	1948 sales value in pounds	No. of firms engaged (in 1948)
Electrical, etc., goods except torch cases, telephone instruments and components, electrical appartus, and lighting and wiring accessories	2,148,000	104
Articles used in the preparation and serving of food and drink	1,525,000	99
Technical moldings, fabricated materials, etc., not included elsewhere	1,389,000	79
Products for motor and cycle trade	762,000	55
Radio cabinets	598,000	15
Cutlery handles	91,000	10
Snap and slide fasteners	10,000	8
Ladies' handbags, pochettes and sling bags	94,000	13
Sheet, rod, tube, solid and liquid resins, etc.	741,000	
Lighting and wiring accessories and fittings	320,000	

The above is taken from Tables 1, 2, and 3 of the article abstracted.

The article in addition to statistics of the British plastics consumption gives figures on imports and exports of certain products. For instance, the total number of buttons produced in plastics, dum and corozo was 5,557,000 gross in 1937 and had risen to 12,536,000 gross in 1948. Of this latter amount, 824,000 gross were exported. The figure for production of hardware, wholly or partly of plastics, was 1,116,000 pounds sterling, of which 130,000 pounds sterling represent the value of exports in 1948.

Successful Molding

(Continued from Page 30)

fact, greater than at the root, this being shown to a somewhat exaggerated degree on the illustration. If the difference between the two widths "a" and "b" were to be only a matter of a few thousandths of an inch, considerable sticking would arise when attempting to remove the part from the cavity.

The radius at the sides where the rib joins to the wall is insufficient, thus forming yet another source of weakness attaching to the design element. The mold parting surface is along line "a—a" as with all the preceding examples, thus embracing the formation of the entire rib channel in one mold block.

Such a rib located upon an external surface of a component would prove most unsatisfactory either from the appearance viewpoint, or as a means for stregthening the article. This reverse tapered rib form could, however, be molded, but it would necessitate parting the mold in a different plane, i.e., at 90 degrees to the one shown at "a—a," the parting thus passing centrally along the rib.

Such a mold construction would then raise additional problems for the toolmaker in that half of the rib formation would have to be machined in each mold block, and these would have to be very accurately matched up, so that no misalignment or steps would be formed at the crest of the rib. To accomplish this would entail greater care, longer toolmaking time, and added cost to the tool.

Printed by special permission of the English magazine "Plastics".

SECTION NEWS

Edited by
Stanley Bindman

New York Host to Newark for Talk on the Plastics Industry in the Middle East

A. M. Merrill

The New York Section was host to the Newark Section at a joint dinner meeting on November 12 at the Gotham Hotel. Some 145 members and guests of the two groups attended and heard two talks: "Methods Engineering in the Plastics Industry," by John A. Schwab, John A. Schwab & Associates; and "The Plastics Industry in Iran and the Middle East," by Sam Silberkraus, Riverside Plastics Co.

Mr. Schwab emphasized that the engineer must consider the human side, as well as the technical aspects, of every plant management problem. Every new management system or technique must be (1) easy to understand by the workers; (2) quickly applied; (3) absolutely consistent; and (4) equitable for everyone concerned. These four factors should be the primary consideration of management, since tools are only as good as the people who operate them.

On the subject of more direct savings by proper engineering, Mr. Schwab discussed savings in maintenance by providing accessibility to equipment; the role of statistical quality control; and better machine utilization and performance by means of predetermination studies. The speaker described his MTM (Methods Time Measurement) system for predetermination of operation times and costs. Based on breaking down all bodily motions into specific time units, MTM is a tool to plan and lay out new manufacturing methods before they are installed. The speaker stressed that the ability to properly apply MTM depends on prior knowledge of how the specific job is done.

Mr. Silberkraus stated that in the area between Israel and Pakistan, the plastic industry is showing signs of activity along modern lines only in the country of Iran, and there only in the city of Teheran. Until last year, this activity was confined to small, hand operated injection molding machines having capacities under one ounce. Within the past year a new company has been organized in Teheran for injection and compression molding with modern machines and techniques. This firm has five injection machines ranging from 4-12 ounces in capacity, and one 200-ton semi-automatic compression molding press. Polystyrene is being used for injection molding to produce combs, tumblers, bowls, small toys, and similar items largely copied from American products. Compression molding is being done with urea-melamine to produce buttons.

The speaker noted that plastics products have excellent acceptance among the Iranian public, the major selling point being the people's love of bright colors. Despite product prices that are comparable to ours and represent 20% or more of a man's daily pay, production of plastics items is insufficient to meet demand. In spite of makeshift machine shop equipment, lack of facilities to heat-treat anything but the smallest metal parts, and faulty mold finishing techniques, the ingenuity of the Iranians is such that molds have been built and are operating in a suitable manner to meet their requirements.

New York Section president Bruno E. Wessinger, Wess Plastic Molds, Inc., presided over the meeting and welcomed the Newark members and guests. Newark Section president Edward W. Rowan, Dillon-Beck Mfg Co., acknowledged the welcome and invited the assemblage to the next joint meeting of the two groups, to be held in Newark on January 14.

Mr. Wessinger and Harold E. Schwartz, Empire Brushes, Inc., and chairman of the New York Section's educational committee, spoke briefly on the educational program prior to the technical session. As the result of the program carried out in conjunction with the New York City Board of Education for the past year, a course in plastics will be initiated at one of the vocational high schools in February. Both Wessinger and Schwartz stressed the need of contributions of equipment from the industry companies for use in the course.

Table favors in the form of brushes and pocket notebooks were distributed through the courtesy of Emence Industries, Inc., and Naugatuck Chemical Division, United States Rubber co., respectively. The meeting closed with a drawing for four door prizes contributed by Empire Brushes, R. C. Molding Co., and Wess Plastic Molds, and won by W. Lynch, Boonton Molding Co.; Mr. Paff, Newark Die Co.; M. J. Sills, Koppers Co., Inc.; and Jerry Sloane, H. Kohnstamm & Co.

West New England Panel Discussion

E. J. Sweenney

The Western New England September 5th dinner meeting was very well attended. Chairman John Mallory held a short business meeting prior with the Technical Section. Mr. John LaBelle, Chairman of the Boston Section, discussed the coming National SPE meeting at Boston.

After the usual door prize drawing, Mr. Ed Childs, Chairman of the Program Committee, introduced a panel of three speakers who discussed Sheet Plastic Fabricating, Latest Techniques and Materials. The speakers were:

W. W. Farr, Chief Sales Service Engineer, Rohm & Haas Company, Philadelphia, Pennsylvania. Graduated from M.I.T. in '26, as an Aeronautical Engineer. Wally acquired diversified experience in aircraft and streamline train design and engineering. He joined Rohm & Haas in 1940 and managed their Pelxiglas fabricating operations during World War II. Since that time he has been instrumental in building up peacetime commercial uses and fabricating facilities.

L. D. Burnett, Jr., Technical Representative, Sheets and Foil Division of Bakelite Company, New York City. Graduated from the University of Virginia in '45 as a Mechanical Engineer under the Navy V-12 training program. He joined the Bakelite Company in '46 after Pacific Theatre service as a Deck Officer on an Attack Transport. Following an extensive training program Lucien has been selling Vinylite rigid sheets in the New York and New England areas.

John Hoy, Plastics Technical Service Department, Plastics Division, Dow Chemical Company, Midland, Mich., has been developing new materials and procedures for two years following a years training program. John graduated from Michigan State in '49 after service with the Army's 1st Cavalry unit in the Pacific combat area during World War II.

The talks were very well received and many questions were presented during the question and answer period.

Southern California Speaker Tells How to "Get Results With People"

Robert L. Whann

Ben L. Wells Shows Types of People

"Getting Results With People" was the topic presented by Mr. Ben L. Wells, of the Ben L. Wells Co., Los Angeles, at the October meeting of the Southern California Section. Mr. Wells has had more than 25 years experience in sales, sales leadership, merchandising research and leadership training.

While in the sales research department of a large national organization, he worked with hundreds of sales managers to help them better understand the mental and emotional attitudes of salesmen. From this experience he developed a program which the salesmanagers used to handle salesmen more easily and effectively.

This program was the basis for his discussion at the meeting. Mr. Wells emphasized the importance of human relations which affect every worker's attitude toward his job and through that his actions on the job. When these actions come to the attention of the public as they so often do in our business, you can understand their effect on public relations and our business.

The technical persons as well as the management and supervisory persons in attendance found the topics which Mr. Wells discussed to be not only very interesting, but also very beneficial, thought provoking and encouraging.

Ed Feeley wins Philly Prize Paper Contest Speaker Describes Epoxy Resins Properties

Adolf J. Kissileff

The November meeting of the combined Sections of SPE and SPI was attended by 80 members.

Members received their first real introduction to the Epoxy Resins from a meaty and very educational address by Russell M. Houghton, President of Houghton Laboratories, Inc., Olean, N. Y. Mr. Houghton delved into highly technical phases of these newly developed resins, establishing proof of their merits as applied to coatings, adhesives and laminates, and displaying samples to illustrate the applications. Perhaps the most exciting use described by Mr. Houghton is the possibility of the future use of the Epoxies in producing forming tools. Following his address, Mr. Houghton conducted a spirited open floor discussion during which many more and varied potential uses were suggested.

George Koch, Local SPE president, presented Ed Feeley of Leeds and Northrup with a check for $25.00, the local prize for his winning Paper titled "Casting Polyester Rod within .002" Tolerance."

Reimer Schact, past president of SPI Local Chapter, announced a U. S. Government sponsored series of Technical Conferences starting December 8th at Drexel Institute of Technology. The conferences are headed by A. V. Aston, Director of the National Bureau of Standards.

Membership of the Philly Contingent of both SPE and SPI were eagerly awaiting our annual Ladies' Night, held on December 16th at Franklin Institute. One of fashion's most prominent women, Editha Austin, former Fashions Editor of Vogue, present Fashions Director of Virginia Carolina Chemical Corp. discussed new plastic fabrics and new fashions made possible by their development. Prizes and favors for the ladies did much to send them home with the feeling that duPont's slogan—"Better things for better living . . ." is more than just a slogan.

New Board members elected to 3 year terms are Dr. Norman H. Skou, Edward J. Fitzpatrick and H. Curtis Colby. Elected to the office of National Director was Dick Bishop, one of Philly's most active members.

Dick Bishop, who is also Philly Program Chairman, announced that January's meeting will consist of a panel discussion by members of the duPont organization and the subject will be—"Nylon Molding." As usual, the meeting will be at Franklin Institute.

Your Philadelphia Section reporter takes this opportunity to wish all of you a joyous holiday, and a healthful, plentiful and peaceful 1953.

St. Louis Speaker On Preplasticizing

Chris Kacalieff

Mr. Fehr of the Watson-Stillman Company was the featured speaker at the November 18 meeting of the St. Louis Section of the Society of Plastic Engineers at the Melbourne Hotel.

Mr. Fehr discussed fully the principles of pre-plasticizing in injection molding including its advantages and disadvantages. Some of the advantages listed were greater plasticizing capacity, strain-free parts, larger area and thinner section molding, and the ability to "starve" a shot and thus exercise better weight control and keep closer tolerances. It was also indicated that lower injection pressures were the rule although on some jobs full injection pressures comparable to conventional machines was needed.

Among some of the disadvantages mentioned was leaking of material around the injection plunger but experiments are underway to evaluate the possibility of using replacable tips for the plunger.

Looking into the future, Mr. Fehr discussed the possibility of injection machines even larger than are available on the market today. Machines of huge capacity, now on the drawing boards, are being studied in the light of the tremendous economic factors involved.

Casting of Acrylics and History of Rubber Resins are Topics at Rhode Island Meeting

John R. Sloane

The Rhode Island and South Eastern Massachusetts Section of SPE met for dinner at Wayland Manor, Providence, R. I. on November 13, 1952. Two outstanding members of the plastics industry presented programs of special interest and educational value.

The first speaker was Mr. Robert L. Carlee, Sales Manager of Plastics Development Inc. of Attleboro, Mass. on the subject of "Acrylic Casting for Industrial Uses." The company is producers of "Clear-Float," a cast transparent embedment. Mr. Carlee described the pioneering work which had been done by Roy M. Slipp, founder of the company. Mr. Slipp who is a member and director of this section, began his experimental work in acrylic casting in his home cellar with the standard methods as supplied by the makers of Lucite and Plexiglas, but a rare amount of inventive genius and imagination enabled him to develop many new methods of casting which served to produce highly artistic and interesting effects in the items produced by his present company.

Mr. Carlee showed a large number of samples of the beautiful articles in current production. Such items as cigarette lighters, cigarette boxes, pen stands, paper weights, key tags, book ends, and many others are designed for general retail trade, while a great many items are custom made for concerns who send them to their customers as good will gifts or advertising media. Miniature bull-dozers, automobiles, machine tools and cut-open electronic parts embedded in acrylic were but a few of the many samples shown.

Plastic Development Inc. contributed a beautiful "Clear-Float" cigarette lighter as a door prize. The lucky winner was Mr. A. Silver of Royal Electric Co.

The second speaker of the evening was Dr. Paul M. Elliott, Manager of Research and Development at the Naugatuck Division of U. S. Rubber Co., on the subject of "Rubber Resin Compositions, Historical Development, Present Materials and Uses."

Dr. Elliott gave a most interesting talk, illustrated with slides showing the comparative values and characteristics of styrene from the early days of its uses as a material for injection molding right up to the present High Impact and Co-Polymer materials generally known as Modified Polystyrenes. The speaker pointed out many applications in which the new materials have proven far superior to general purpose formulas. Dr. Elliott also showed samples of molded articles in which these new materials were used with highly satisfactory results. Among his interesting display were samples of extruded pipe, as well as molded couplings, tees and elbows. Comparing this plastic pipe with conventional metal pipe Dr. Elliott stressed its light weight, low cost, absence of corrosion, and ease of installation. He pointed out that threading of the smaller sizes could often be done by merely holding the pipe in one hand and the tap or die in the other hand.

Membership in the R. I. and S. E. Mass. Section is experiencing a healthy growth. Mr. Allan Barker, Plastics Engineer with The Monowatt Co., and Mr. Augustus Becker, Production Manager and Treasurer of the Barbeck Co. Inc., have applied for membership.

A Meeting of the Directors to elect officers for 1953 will be held on December 3, 1952. The Annual Meeting of this Section will be held at Wayland Manor on December 11, 1952. On this occasion the speaker will be Mr. C. W. Cleworth, Publisher of **"Plastics World."** His subject will be "Outlook for the Plastics Industry in 1953."

Connecticut Hears About Polyesters, Reinforced Plastics and Insulating Materials

David Mersey

The November meeting of the Connecticut Section took place at Bridgeport on the fourteenth, with forty guests and members present.

The business portion of the meeting was a long one, with three speakers and a film. Owens Corning Fiberglas Corp. sent two representatives, Robert Mulligan who spoke on, "Electrical Insulating Materials," and John Sayre, who talked on, "Reinforced Plastics." This was followed by a presentation on "Polyesters" by Richard Malamphy of the Naugatuck Chemical Co. Between the Fiberglas and resin portions of the session, there was laminated the film, "The Magic Marble," also by Owens Corning.

Mr. Mulligan stressed that Fiberglas had so many applications in the electrical field, not because of its electrical properties, but because of its mechanical performance. Of its many characteristics, its better known are:

1. Its non-combustability and high temperature resistance;
2. Its resistance to rot, fungus, decay, corrosive vapors;
3. Its resistance to acids and alkalis;
4. Its good dimensional stability.

Fiberglas comes in a multitude of forms, as, yarn, sleeves, tubes, laminates, cloth, sheath, etc. The company sells its product directly to the user or to converters for further processing. One of the newest applications of this material, is the addition of chopped glass fiber to plastics to give rigidity to wire and cables.

Mr. Sayre pointed out that because of its high tensile strength Fiberglas has many applications as a structural and reinforcing material. In this field, the fiber comes in three forms, roving, mat, and, fabric. Roving is used in the preform process of molding, and for this field, Mr. Sayre offered a few admonitions, namely, the avoidance of sharp corners and abrupt thicknesses. Many molded parts were exhibited, helmets, tote-boxes, pipe, aircraft parts, etc.

Mr. Malamphy described the polyesters as being thermosets, usually used as a compression material, sometimes as a transfer type. It is usually a liquid of varying viscosities. Shelf life runs from six months to one year. It is cured with heat, catalysts, and recently several promoters (accelerators) have been developed to further facilitate curing. Mr. Malamphy also demonstrated the making of a laminate, using fabric, resins, and a promoter.

The movie, "The Magic Marble," showed the manufacture of glass fibers, starting with the marble and finishing with finished consumer products. This film was in sound and color, and was an excellent aid to the speakers.

In many respects this program showed the merger of one of the oldest and one of the newest technologies, glass and plastics respectively. At the same time it showed two of the newest developments in both fields.

Kel-F is Topic At Cleveland

F. A. Martin

Seventy members and guests attended a dinner meeting at the Spanish Tavern in Brecksville on November 24. The speaker of the evening was Mr. Jules Jupa of the M. K. Kellogg Company. His discussion of the properties and fabrication techniques of Kel-F aroused a great deal of interest among those present as evidenced by the large number of questions. Mr. Jupa covered molding, both compression and injection, and extrusion techniques. Since he has been associated with Kel-F from the initial development stages, he was able to bring an authoritative picture to his audience.

The Cleveland Section ended the year with a Christmas party. Arrangements for the party were handled by Ward Van Orman, assisted by Cliff Sauerwein and Syl Caldwell.

Pribble Talks on Molds At Toledo Meeting

Robert F. DeBrock

The Toledo Chapter of SPE held its November meeting on November 18, with dinner at Harrison's Ranch House after which a short business meeting was held.

At the meeting Mr. R. E. Dunham reported on the National Council Meeting held at Athens, Ohio recently. A brief discussion followed his report.

A request was also made of the members of the Toledo Chapter to offer any information or other facts of interest that could be sent in for the SPE Journal which would tend to diversify the reports somewhat. It was also suggested that items of a personal nature be included because of their interest in the particular chapter involved.

The President, W. E. Fillmore, commented on the fact that there had been some inquiries from the University of Toledo for placing of foreign students in local industry. The reason behind this was to give them a broader knowledge of our manufacturing processers as well as the factory and labor conditions here in the United States, and urge that any of the Toledo members who own or control businesses be receptive to interviewing the students and possibly placing them in their plants in some manner.

Mr. Wayne Pribble of Barrier-Pribble & Co. Inc. was the main speaker of the evening and held a discussion on mold design and the various problems that accompany mold design.

Mr. Pribble went on to point out the effectiveness of constructing a good mold even at a somewhat higher cost and cited various examples of stories where time had been lost or where time had been saved because of the particular type of mold construction. Mr. Pribble went on to comment that perhaps three major things were most important in mold construction and mold design and they were honesty, loyalty and enthusiasm. He further explained that honesty should be prevalent in the information given to the prospective customer, who is buying the mold and what to expect from it as well as what particular faults it might have. Loyalty was explained as being careful to guard any particular facts that have been given to the mold designer and which were more or less of a confidential nature with the future mold owner because of the fact that they may or may not have an important part in the competitive field that the molder will enter. Enthusiasm, of course, should be in evidence because of the genuine interest that a mold designer should have in the mold he is constructing as well as its ultimate production life.

Mr. Pribble's talk was very interesting and it was felt that a great deal was gained by having him address our Chapter at this particular meeting.

Blow Molding Talk At Rochester

E. W. Goral

The Rochester Section met at the Clintonaire Restaurant Monday evening, November 17, 1952 and heard Mr. Arthur V. Todd of Plax Corporation speak on "Blow Molding of Plastic Bottles." The general technique involved in vertical extrusion of cellulose acetate butyrate and polyethylene containers in clam shell molds was enlightening. The wall thickness of bottles is determined by the original wall thickness of the tubing used in blow molding. It was also pointed out that different molecular weights of polyethylene are required for packaging certain chemicals in containers and that Plax Corporation is continually conducting tests of this nature together with good mold design for properly fulfilling packaging requirements.

Cost of molds for producing bottles by blow molding are less expensive than the conventional injection molds.

Prices of containers are usually compared with glass by the chemical and cosmetic industries, however, the increased demand for polyethylene containers is based on the fact that they are unbreakable, light in weight, inert to chemicals, and available in an almost infinite range of colors. An enormous number of items used in packaging and industrial applications were on display and represented the amazing versatility of polyethylene containers.

Northern Indiana Hears About Nylon

Philips A. Leonard

The November 21st meeting of the Northern Indiana Section of the Society of Plastics Engineers, Inc. was called to order by Mr. Ferris Newman, President, in the Engineering Auditorium of the University of Notre Dame.

Minutes of the previous meeting were read by the Secretary-Treasurer and approved.

The speaker for the evening, Mr. B. H. Barnes who is in charge of the Development and Service Section of E. I. DuPont deNemours & Co. was then introduced by Mr. David James, technical representative for the DuPont deNemours Company. The subject of the meeting was a discussion on the physical properties and uses of Nylon and illustrated slides were shown. Samples of the present uses of Nylon were shown and a very active question and answer period followed the discussion.

An informal dinner meeting was held at Nabricht's Restaurant with Dean Lawrence Bollinger of the College of Science of Notre Dame University as a special guest at both the dinner and the meeting.

An attractive door prize, a desk pen with a Lucite base, was donated by the E. I. DuPont deNemours Company. Approximately 30 members and friends attended the meeting.

Extrusion at Newark

W. J. Trautweiler

The October meeting of Newark Section, held at the Military Park Hotel, was attended by approximately 70 members and guests. The program consisted of a very excellent presentation of the topic "Extruding Vinyl Film" by Mr. H. M. Zimmerman, Senior Technical Service Engineer, Plastics Materials Dept. of B. F. Goodrich Chemical Company.

Vinyl film has been produced in very large quantities by calendering procedures, however, in recent years there has been a definite increased interest in the adoption of extrusion methods for producing films and sheeting. Mr. Zimmerman described in detail the process of extruding vinyl film, the necessary extruder equipment as well as the cooling and take-off equipment. The problems which are normally encountered in this process were reviewed and suggested methods of correction made by Mr. Zimmerman, which was followed by a question and answer period.

Elliott at Detroit

Emil Gazdick

A dinner meeting was held November 18th., at the Rackham Memorial Building in Detroit.

An exceptionally interesting talk and demonstration was given by Dr. Paul M. Elliot of Naugatuck Chemical Division of United States Rubber Company, to the members and guests of the Detroit Section of the SPE.

Dr. Elliott started his talk with a brief history of thermoplastics and the eventual development of polystyrene. The need for improved plastics for certain applications led to the development of styrene copolymers. Along with these developments came the introduction of Kralastic. Dr. Elliott supplemented his description of Kralastic properties and uses with slides.

During the second half of his talk, Dr. Elliott discussed Vibrin resins. Of particular interest was his demonstration of curing one of the Vibrin resins.

The meeting was followed by a lively question and answer period.

The Detroit Section held their annual Christmas Party on December 16th., at the Park Shelton Hotel.

Plastics Industry to be Billion Dollar Business in 1953 is Prediction

Expansion of the plastics industry to a 8 billion dollar volume in 1953, was predicted here by M. A. Self, president of Bee Chemical Co., in his address on Wednesday evening, November 12, before the joint dinner meeting of the Chicago Section of Society of Plastics Engineers and the Society for the Plastics Industry. The meeting was held at the North Park Hotel. Members of the panel which discussed different techniques of coating plastics were: Dr. Lloyd Parks, vice president of Bee Chemical Co.; Sidney Melnick, assistant plant superintendent of G. Felsenthal & Sons; Henry J. Kalmus, President of Kalmus & Associates; and Thomas F. Muckenfuss, general manager of J. B. Products Co.

Dr. Parks discussed the various types of coating materials most suitable for different plastics; Melnick explained how better plastic product design made decorative finishing easier and cheaper to apply; silk screening as a decorative finish for plastics was advocated by Kalmus; and Muckenfuss explained how vacuum plating of plastics gave a "metalized" finish. Finally, Self summed up the discussion and answered questions.

"While federal data show that the use of plastic materials has grown from a mere 70 million pounds in 1935 to over 2 billion pounds in 1951," Self said, "the significant fact is in 1935 about zero per cent of all plastic items made had a decorative colorful coating, whereas in 1951, an estimated 24 per cent had such a decorative coating. The trend over the years has been for our industry to coat its plastic products with a wide variety of coatings which not only preserve the product against heat, moisture, abrasion, grease, etc., but add to its sales appeal. In good part, this added sales appeal has helped boost the plastic industry to its present size.

"Not more than a few years ago," continued Self, "we found decorative coatings on only a few plastic items such as auto horn buttons, small name plaques and similar ornamental gadgets. Today, we not only find decorative coatings on plastic refrigerator doors, radio cabinets, electric advertising signs, pen and pencil sets, toys, automobile taillights, dashboards and seat covers, furniture, kitchen equipment, etc.—which help preserve these items—but we find that the customer likes the color, the glisten and the gloss, which makes the selling problem easier."

Self related how in years back, the plastics industry would beg industrial designers to try some plastic for special use. Now, he indicated, the use of coatings on plastics has so popularized these materials, that industrial designers camp at the doors of the various coating manufacturers to find out what new developments are available for industrial and consumer application.

"The real fact is," said Self in conclusion, "that no field today is immune to the influence of our plastic products. I find plastics manufacturers producing all sorts of laminated polyesters which, pound for pound, have greater tensile strength than steel, and will be used where light steel was used before, and at a much lesser cost. I find plastics manufacturers perfecting plastic which will be used in place of wood for houses. These plastics will resist weathering at least 10 times more effectively than wood, and they will be cheaper. In time, every item going into the building of a house will be made of plastics. I find all sorts of lighting fixtures, furniture, sports equipment, automobile bodies, etc., all being produced of plastics today. These will almost all be coated with decorative finishes to enhance sales appeal.

"The plastic molder's big problem today is to find out what decorative coating best suits the plastic he is working with, and is most attractive to his potential customer. Our discussion tonight covers the major coating materials available to molders, and how they can best be used. If the plastic molding industry in Chicagoland stays ahead of the industry nationally — as it has been doing heretofore — we will continue to be the nation's foremost plastic product producer."

Performance of Injection Machines: Toronto

G. M. Hale

The October meeting brought us as guest speaker Mr. E. Gaspar, chief designer of The Projectile and Engineering Company Limited, London, England. His topic was "Basic Features influncing the performance of Injection Molding Machines." It was illustrated by slides.

The Projectile and Engineering Company Limited is a leading engineering concern in Great Britain and its products are in use throughout the world. PECO injection molding machines have distinctive features resulting from their own modern technical research and experience. In his capacity as chief designer, Mr. Gaspar was well qualified to discuss his subject.

In his talk, Mr. Gaspar discussed those variables most likely to influence the quality and output of moldings as far as an injection molding machine is concerned.

Characteristics of Injection Molding Machines.

Shot capacity, plasticizing capacity, injection pressure, rate of injection, and mold locking force were defined and their relationships discussed.

It was suggested that as a general guidance the ratio between the plasticizing of any machine in pounds per hour and the shot capacity in pounds, should not be less than 100. The larger the size of machine the more difficult to maintain this ratio hence the tendency to pre-plasticizing chambers.

Maximum locking force theoretically determines the maximum projected area with the weight of the molding determining its equivalent wall thickness. In practice it has been found that on a flat disc this wall thickness can be greater than generally required, and the depth of the molding finally determines the maximum wall thickness.

The rate of injection is generally proportional to the shot capacity of the machine.

Quality of Moldings.

Mr. Gaspar covered the common problems of injection molding—short moldings, flow and weld marks, shrinkage, craze and score marks, staining marks, and internal stresses. The effects of the characteristics of injection molding machines on these quality problems were discussed.

Pin Point Gating

Thermo-dynamic experiments were described which supplied authenticity to a proposed theory explaining the satisfactory results commonly obtained with pin point gating. It was suggested that in the case of pin point gating the core of the runner which loses least of its heat enters the pin point gating. Furthermore, the turbulence and pressure caused in front of the gate are partly converted into heat to make up losses in the runner.

Mold Temperature Control

With the advent of more intricate moldings and due to the dimensional stability required, accurate control of mold temperatures is almost a necessity. The mold temperature controller should be able to put heat into or withdraw heat from the mold while maintaining the temperature of the mold at a pre-set constant level.

Production Speeds

Brief reference was made to the way in which injection molding machine characteristics influence the output of the machine.

Little GREMLINS In Mold Design

Wayne Pribble
Barrier-Pribble and Co.

After 15 years of very intimate association with the problems involved in designing plastics molds for all types of materials in many sizes, shapes and descriptions of parts, I have arrived at two inescapable conclusions and these are: First, unexpected trouble is most frequently encountered in the "so called easy jobs." Second, the small details of design are the gremlins.

The customer usually encourages the gremlins involved in the small detail. Either through ingnorance or carelessness, his designers leave unanswered detail in the part which they wish to have produced. Their line of reasoning seems to be "Oh well, that doesn't make any difference, do it any way you like." The plastics mold designer, not knowing exactly how the part is to be used has a good chance of doing the wrong thing.

One of my first experiences with this gremlin was in designing a mold for a switch case. A raised boss had a rib on one side of it, the rib was not clearly located on the customers drawing and I used assumptions and scale measurements to locate it in the mold. Unfortunately, the location of that rib vitally affected the function of the switch and 10 new cores had to be made at the cost of several hundred dollars. Now that experience taught me one thing, "Don't take **anything** for granted."

I believe I am safe in saying that some of our clients have been just a little irritated at our insistence on covering all the things which they regard as minor details. We feel that it is the duty of the designer to call every conceivable item to the attention of the party that is responsible for the production of a part to a specification. We also feel that the molder is offering a real service when his engineers do a major portion of this before he gets an order. Too many times the molder has to go back to the customer and ask for deviations that should have been requested when the quotation was made.

By the same token, I believe that many users of plastics have the attitude that the molder who gives a really detailed quotation is only trying to cover up a poor job by saying "exception was in the quotation." If you are an end user of plastics, you should welcome and insist upon the molder giving you enough detail that you know exactly what you are going to get. Quite often you would save a lot of money if you listened first instead of afterward.

The small things in mold design that are often overlooked or are left to the tool maker are such things as exactly how is draft to be taken? Does it taper large or small? The design should show it. How much clearance should be allowed between various sliding or telescoping mold sections? Again the designer should give the mold maker some theoretical perfect dimensions for these mating parts.

The mental attitude of the designer is often a contributing or determining factor in how well a mold operates. The designer should feel that the weight of the world is on his shoulders. An engineer can give the general plan of a design, such as, material to be used, type and size of mold, ejection, and gating, but only the designer can give the minute details of draft, clearances, overflows and vents the attention they need.

Fortunately the attitude that molds are a necessary evil is disappearing. The plastics industry is joining the automotive and other high production industries in recognizing that economical production is based on intensive planning of intricate details.

I firmly believe that attention to apparently insignificant detail is the basis of good mold design.

The Injection Molderscope

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machines. It is as good a summary of the matter as there is and you should write them and ask for it. Weighed feed has really taken hold, and the midwest again leads the parade, having more units in operation than the rest of the country combined. By weighing out the charge you speed startups, eliminating initial over and under fills, and you produce pieces of a more accurate dimension and weight. Indeed, I would guess that no piece should be molded today where a critical dimension is to be held without using weighed feed.

The initial importance of this development was obscured because when Gordon Thayer first introduced it at the '52 SPE Technical Conference he was talking on Heavy Section Molding as he was asked to. Actually weighed feed was his main theme, and it was kind of lost in the assigned topic. Henceforth, it would certainly be in order for the speakers' committee of the Technical Conference not to insist that the speaker follow an assigned topic if he has something of industry—revolutionizing importance (like weighed feeding of injection machines, for example) to talk about!

THE LESTER PRESS

The Lester Engineering Company, 2711 Church Avenue, Cleveland, Ohio publish a house organ called **The Lester Press.** Even if you are not a user of Lester type

(Please turn to Page 42)

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Plastics Training for the Electrical Engineer

Murray Olyphant, Jr.

Princeton University, Princeton, N.J.

Since SPE now endorses an educational program for training engineers plastics it seems desirable to consider what may be the sentiments of industry with regard to the value of such training. The program as now outlined is adaptable to the education given with any of the usual engineering backgrounds, physics, or chemistry; and we may expect that the opportunities for these men will differ with their basic training. The electrical engineer presents possibly the most problematic source of plastics engineers since his concern with plastics will most likely result principally from their use as electrical insulating materials. For no other reason perhaps than the availability of some information on the subject the electrical engineer will be the first considered in this column.

Is academic training in plastics for the electrical engineer worthwhile? Will industry find such a man of sufficient value to pay a premium for the time spent acquiring this training? In order to answer these queries a questionnaire was submitted together with the brochure outlining the SPE program to people in a number of industries. Thanks to an unexpectedly good return some attempt can be made to answer these questions. First, the larger electrical industries through their own training programs, will probably do as good or a better job for their particular needs as can an academic program which must in this case adapt to a variety of backgrounds. Industrial training will be more specialized, particularly with regard to insulation, than can be supplied by the recommended program. In addition some smaller companies which produce materials or fabricate parts may feel that a mechanical engineer or chemist with added training in electronics or insulating materials would be more useful.

The large majority of those replying to the questionnaire, including capacitor, electronics, insulating tape, cable, and instrument manufacturers, laminators and molders felt that the training could be of considerable value to them, in various fields from research to sales. What they would expect of a man so trained we can not do more than surmise; but certainly if an electrical engineer is not to limit the opportunities available he will require training in a variety of subjects including polymer chemistry, fabricating methods, electrical and mechanical behavior, properties, and applications of materials, dielectric measurements and possibly equipment design. Such training is now incorporated in the SPE program.

This does not constitute an unqualified endorsement for the latter, however, because there remain other questions to be answered having to do with how to attract engineers to the program and what subjects to emphasize. Specifically, as the program is now set up the electrical engineer, if he is interested in graduate work, must sacrifice the benefits of graduate study in electrical engineering for a program which is mainly untried, and which may very likely lead to jobs which, although remunerative, are not of a sort to stimulate the interest of many electrical engineers. Again, as one respondent noted, most electrical engineers are allergic to chemistry, to which might be added in many cases, insulating materials and measurements. If it should be found, as it very well may, that whatever the need for the training described, the program appeals largely to those who are somewhat dissatisfied with electrical engineering, the attraction of good men will be hindered. Many if not most electrical engineers who have an interest in graduate work are imbued with an enthusiasm for electrical engineering and display little desire to switch fields. To attract good men from the electrical engineering department into the completely unfamiliar world of plastics will probably require, at least at the university level, a strong appeal. It seems likely that some changes in the curriculum will be found desirable to provide this appeal.

Some of the positions in which an electrical engineer with plastics training would be of value could very possibly be filled as well or better by a mechanical, or chemical engineer or chemist with the added knowledge of materials, electrical measurements, and electrical properties which is provided by the SPE program. It seems quite likely that electrical engineers would find more interesting a program with a broader emphasis on electrical insulation, not necessarily limited to plastics, including a thorough grounding in dielectric behavior and properties, and more comprehensive study of insulation applications and electrical measurement techniques. Where this can be provided by elective courses and thesis study it can be accommodated by the present program but some additional modifications may be desirable.

There is no doubt that there are many fine opportunities in the plastics and insulation field for electrical engineers with SPE training. It seems probable that the principal impediment to a supply of such men is the E.E. student himself who may not be readily persuaded early enough that changing fields can be worthwhile.

In the hope that SPE Journal readers may find such comments interesting and useful the Education Committee has been encouraged to contribute occasional brief resumes of various aspects of the educational picture including discussions both of the problems which are encountered in providing training in plastics for engineers and of the progress which has been made in deciding upon suitable courses and encouraging engineers to pursue them.

The Injection Molderscope

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injection machines you should write them and ask to be put on their mailing list as the paper often contains many interesting pointers on injection molding. The latest issue describes a beryllium-copper nozzle of the flat nosed type which is said to improve greatly the performance of the Lester type nylon attachment where the whole injection cylinder is pulled up an inch or so shutting off the nozzle. This is the only type of nylon shut off nozzle that gave any promise at all. Nylon nozzles of the latest Paggi design can now be readily made for the Lester type of machine by substituting for the two piece nozzle and extension assembly normally used on the Lester a one piece extension nozzle incorporating Mr. Paggi's latest 5/32" center hole nozzle, where a very small tube of material goes right thru the center of the nozzle. This 5/32" material column is much easier to control than larger columns previously used. It seems more and more, that it is being admitted that the nozzle must be designed and treated like a runner! But back to **The Lester Press**—ask them to put you on their mailing list if you are interested in news of interesting injection molding developments.

Birckbats and Plaudits

These brief December days bring up remembrance of the time Editor Jesse Day and I first discussed the problem of the SPE Journal. Jesse said that one of his biggest editorial problems was the sporadic lack of material for the paper. Out of this conversation came this regular column or feature. There have been mixed reactions to it. Some people have said, "It looks like you are running the paper for Ren Morse!" And others have felt that some of the articles have been invaluable summaries of very specialized information not available anywhere else. Our frankness, while it has irritated here and there, has been generally well received, since most articles those days are so DARN polite that any **real** information is hard to find in them.

To my critics I would say—if YOU can make a better contribution to the SPE Journal, PLEASE DO IT. (I wonder if you know just how much time it takes to prepare a simple page of material like this each month?) If YOU had been coming through REGULARLY with enough Section News, Technical Papers, etc. etc. the column would never had to have been started in the first place.

To those larger number who have received **The Injection Molderscope** favorably—many thanks for your good wishes. A job like this takes too much time to keep it up, and if the Feature's well-wishers had not far outnumbered its critics, I am sure the SPE Editorial Board would have sounded the 'Scope's death knell long ago, and I would not have continued to put all the necessary hours on it—hours I can ill afford to spare to an unrecompensed project in these hard and busy days.

One more thing. There is always the stigma of authorship to contend with: a mark among the more rugged brethren of our injection industry that if you write about something you are not a "doer." Anyone who writes is looked down upon as impractical or theoretical by the Hard-Knock Boys of the Injection School, and this can be a definite handicap both in business and in engineering—one perhaps that I would do well to be shed of. So to my critics I say—get out the Section News, contribute something yourself, and you'll knock this column right in the head!

Industrial Literature

A brochure presenting a picture of the present applications and broad possibilities of nylon may be obtained from United Plastic Industries, Inc., 14 Brown St., Vassar, Michigan.

The new Conas Bulletin T-C L illustrates the complete line of Conax Bare Wire Thermocouples. Conax Corp., 4515 Main St., Buffalo 21, New York.

Data sheets on Polyco 426 and Polyco 497 (water dispersions of a Nitrogen-containing terpolymer, and of PVA copolymer, respectively) are available from American Polymer Corp., Peabody, Mass.

The 1953 Catalog of IMS Injection Machine Nozzles is off the press and may be had by writing Injection Molders Supply Co., the Penton Bldg., Cleveland 13, Ohio.

A number of general purpose adhesives and other products developed by Chemical Development Corporation, Danvers, Massachusetts, for the plastic industry are now available in small containers for experimental purposes and for re-sale through distributors and dealers to small volume users. Packaged in 8 oz. and quart containers, these materials should prove of particular value to those who require products which will meet their exact requirements. The following product represents only one of the more than 200 materials now manufactured by Chemical Development for the plastic and allied fields.

CD CEMENT #100 is a general purpose, high strength adhesive for Lucite, Plexiglas, and Polystyrene. It is non-inflammable, colorless, fast acting, and produces a clear bond. It will not deteriorate in storage. This product consists of several strong active solvents. Plastic shavings can be quickly dissolved in the solution to produce a semi-viscous adhesive or protective coating if desired

The 1953 edition of the booklet, **"Physical Properties of Synthetic Organic Chemicals,"** has just been issued by Carbide and Carbon Chemicals Company, a Division of Union Carbide and Carbon Corporation. This 20-page booklet is issued annually and is an important guide for users of organic chemicals.

Write for free copy to Carbide and Carbon Chemicals Co., 30 East 42nd St., New York 17, N. Y. Write for the P.P.S.O.C. Booklet F-6136.

"Quick, Is —, that one's getting away!"

Central Ohio Hears Talks on Nylon

A. P. Young

Mr. John Lachmann, Polychemicals Department Field Service Laboratory, E. I. duPont de Nemours & Company, Arlington, New Jersey, talked before the Central Ohio Section of the Society of Plastics Engineers at Columbus on November fifth. A native of New York, Mr. Lachmann began his career in industry twenty-eight years ago as a laboratory assistant for LeDoux & Company of that city. He was an analytical and research chemist with several concerns and, just prior to his association with du Pont, gained first hand knowledge of the plastics requirements of the wire and cable industry as a product engineer for the Federal Telephone and Radio Corporation of Clifton, New Jersey. Since 1945, Mr. Lachmann has been closely identified with developments in the processing of nylon and other du Pont plastics.

In his talk, he described the properties of the various nylon molding powders produced by duPont. Particular attention was paid to the design of various parts of extrusion machinery best suited for handling nylon. Details, including die design, were given for various types of extrusion, including the coating of wire and cable, tubing, shapes, and sheeting.

Industrial Hydraulics At Miami Valley

John L. Russell

Mr. E. O. Clark, Sales-Manager for Industrial Products, Vickers, Inc. Detroit, Mich., was the speaker at the November 6 meeting of Miami Valley Section which began with dinner at the Wishing Well, Centerville, O. His topic was "THE FUTURE OF INDUSTRIAL HYDRAULICS." A Sound Movie on "Flow Hydraulics" also was shown.

Mr. Clark was born in Dayton, graduated from the University of Detroit in 1930 with a degree of Bachelor of Electrical Engineering and has been with Vickers since 1935. He took over the New England territory in 1939 and was District Sales Manager from 1943 to 1950.

Reservations for the dinner meeting were handled by Martin Kasch, of Kurz-Kasch, Inc. and Ralph Backscheider, Recto Molded Products, Inc. Cincinnati, O.

Byron Nelson of the National Cash Register Co. and John Brierley, Bakelite Corp. represented Miami Valley Section on the "Blueprints for Tomorrow" program over Television Station WLW-D on Sunday, November 23. It consisted of a demonstration showing the quality of materials and their proper application. The purpose was to show the extent of plastics in our own everyday lives and to enlighten the public to the fact that plastics are important materials.

Dr. Gustavus Esselen

Dr. Gustavus J. Esselen, 64, Boston research leader, died suddenly on Wednesday, October 22nd, at his home, 99 Gale Road, Swampscott, Massachusetts.

Dr. Esselen was a Vice President of the United States Testing Company, Inc. and director of its Esselen Research Division in Boston. Prominent in the field of chemical research for over forty years, he was the founder and president of the Esselen Research Corporation, which was merged with the U. S. Testing Company in 1950.

During World War II, he was a consultant to the Baruch Rubber Survey Committee and later was chairman of the Tropical Deterioration Administrative Committee of the Office of Scientific Research and Development. He was an active member of many professional, civic, and religious organizations.

DeBell & Richardson Announce Appointment

Kenneth T. Barker, who has been handling chemical engineering plant design for DeBell & Richardson, Inc., has transferred as chief engineer to Shore Line Industries of Clinton, Connecticut.

Fred E. Wiley has returned to DeBell & Richardson, Inc., to be in charge of mechanical engineering and test procedures; and Sven Richter, consulting engineer and formerly manager of the chemical department of Svenska Oljeslageri AB, Gothenburg, has taken over the duties previously handled by Mr. Barker.

HAVE YOU MADE YOUR HOTEL RESERVATION?

To be sure of getting a room for the SPE 9th Annual Technical Conference in Boston, January 21, 22, 23, make sure to get your reservation in without delay.

Hotel Statler, Boston

Industrial Literature

Blaw-Knox Company has just published a new bulletin, Number 2403, entitled "Process Equipment." This 12-page illustrated brochure describes a variety of process equipment designed and manufactured by the company. Included are such items as auto-claves, agitator assemblies, quick opening doors, extractors, cookers, resin plants, packaging pilot Copies may be obtained by writing the Blaw-plants, and package heating and cooling units. Knox Co., Farmers Bank Building, Pittsburgh 30, Pa.

A new, 8-page brochure describing the squeezable Plaxpak polyethylene bottle has been released by Plax Corp., West Hartford, Conn.

Illustrated with pictures of typical products packaged in the plastic "squeeze bottle" container, the catalog covers the functional characteristics and design considerations of the resilient bottle. Typical uses including those for industrial and laboratory, medical, household and utility, and cosmetics applications are listed. Data on closures and accessories and printing and labeling techniques are also given.

Copies of the new brochure are available from Plax.

Publication of a revised technical bulletin, "REZYL Resin 50-5", was announced today by American Cyanamid Company's Plastics and Resins Division.

REZYL 50-5, an oil modified alkyd resin, is designed specifically for high quality nitrocellulose furniture lacquers which have superior cold check resistance, and excellent rubbing and polishing qualities.

The bulletin, which describes in detail the properties of REZYL 50-5, contains a chart of suggested formulations for the product.

INDUSTRIAL FABRICS BOOKLET ISSUED BY WELLINGTON SEARS

Wellington Sears Company this week announced the issuance of a 24-page, illustrated booklet on industrial fabrics with the title of "Modern Textiles for Industry."

Several months in the making, the booklet is an interesting word-and-picture round-up of factual information on industrial fabric applications and developments. The reader is taken through from fiber to end use in many different types of industry. It is authoritative in that it reflects the 107 years' experience of Wellington Sears in developing and specifying industrial fabrics and the tremendous variety of special constructions being produced for industrial customers today by the mills of West Point Manufacturing Company, Wellington Sears' parent organization.

Willfred W. Lufkin, Jr., president of Wellington Sears, announced that in addition to distribution among present and potential users of industrial fabrics, the booklet will continue to be offered to readers of the company's extensive advertising campaign for this type of textiles.

A new catalog on Eclipse Type-D "Steamboilerplants" has been recently published by Eclipse Fuel Engineering Co., Rockford, Illinois.

Write to Eclipse Fuel Engineering Co., 1002 Buchanan Street, Rockford, Illinois.

NEW CATALOG AVAILABLE ON BRUSH READY MADE TAPPED HOLES BRUSH SCREW LOCKING INSERTS

Ready made tapped holes for use in sheet metal and screw locking inserts for use in solid plastics, metals, and other materials are fully described in a new catalog of the Brush Nail Expansion Bolt Company. The tapped holes and inserts are quickly applied, self-locking, available in standard as well as special types and sizes, in aluminum, steel, and other desired materials. Catalog will be sent by the manufacturer, Brush Nail Expansion Bolt Company, Greenwich, Connecticut.

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November, 1952

The spool job and telephone job we have mentioned before are good examples, but did you see those first samples on W. J. Gamin Co's. (Jackson, Mich.) "SPICEMASTER"? We designed the part for plastics and then designed a 1 cavity injection mold for it. The mold was a stripper plate mold with a center gate. You know, most of the molding surface was in the cavity but we applied our knowledge of design to make the part stay on the force for easier ejection. Akromold, Inc., Akron, O., made the mold from our design. Mr. Bedell of Michigan Molded Plastics, Dexter, Mich., tells me the mold operated quite satisfactorily.

Yours for better living with plastics
Wayne Pribble

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